THE AMERICAN GAS LIGHT JOURNAL

PUBLISHING OFFICE No. 32 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, HEATING, MECHANICAL, CHEMICAL AND GENERAL SCIENCE.

VOLUME LXVIII. No. 6 Whole No. 1,183. | NEW YORK, MONDAY, FEBRUARY 7, 1898. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager. THOMAS J. CUNNINGHAM and ELBERT P. CALLENDER, Editors.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND-CLASS MATTER.

Published on each Monday of the year, at No. 32 Pine Street, New York.

Collections are invariably made directly from this office for subscriptions, advertisements, etc. We have agents to solicit the same, but they are not authorized to receipt for money.

Terms of Subscription, Including Postage—For the United States and Canada, $3 per annum. European countries, $4.50 (19 shillings—22½ francs). All payments to be made in advance. Single copies, 10 cents.

Correspondence.—Wishing to make this JOURNAL a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

Remittances should be made either by post office order, express money order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

The American News Company, Nos. 39 and 41 Chambers street, New York, are agents for this JOURNAL. Newsdealers will send orders to them.

The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

CONTENTS

An Asterisk (*) denotes an illustrated article.

OFFICIAL NOTICES—
- February Meeting, Society of Gas Lighting 201
- February Meeting, Guild of Gas Managers 201
- Twenty-eighth Annual Meeting, New England Association of Gas Engineers 201
- Fifth Annual Meeting, Michigan Gas Association 201

EDITORIALS
- Briefly Told 202
  - The Twenty-eighth Meeting of the New England Association—Two Chapters in the Arrangements for the Forthcoming Meeting of the Western Gas Association—Notes.
- The Incorporated Institution of Gas Engineers and the Standard of Light 202
- History of Nitrogen in Coal, by Mr. Herman Poole, F.C.S. 204
- Action of Sulphuric Acid on Coal Gas 206
- Electric Lighting for Profit, by Mr. Alexander Dow 206
- On Cerium, by M. Boudouard 208
- The Sulphur Contents of Coke in their Relation to Blast Furnace Practice 209
- Mica and its Uses 210
- *The Winn Gauge Glass Fittings 211
- The Text of a Bill to Regulate Gas Rates that is Worth Study 211
- The Arguments on the Appeal in the Matter of the Lease of the Philadelphia Gas Works 212

ITEMS OF INTEREST FROM VARIOUS LOCALITIES 213
- Something from Lansing, Mich.—Death of Mr. John O. Hudson—Annual Meeting, Springfield, Mass.—Annual Meeting, Los Angeles, Cal.—The Louisville (Ky.) Company Objects to the Trading of the Kentucky Heating Company—Gen. Thayer Takes a Place with the U. G. I. Company—A Budget from "Observer"—Contract for the Logan Iron Works—Annual Meeting, Summit, N. J.—Annual Meeting, Yonkers, N. Y.—The Pennsylvania Heat, Light and Power Company—Proposed Works for Great Falls, Montana—Annual Meeting, Greenville, Ohio—And Many Other Items.

- Peace in the Western Coal Trade 215
- The Market for Gas Securities 215

[OFFICIAL NOTICE.]

February Meeting, Society of Gas Lighting.

OFFICE OF THE SECRETARY, Feb. 4, 1898.

The February meeting of the Society of Gas Lighting will be held in "The Arena," No. 39 West 31st street, New York city, at 3 P.M., of the 10th inst.

FRED. S. BENSON, Secretary.

[OFFICIAL NOTICE.]

February Meeting, Guild of Gas Managers.

OFFICE OF THE SECRETARY, Feb. 3, 1898.

The February meeting of the Guild of Gas Managers will be held in Young's Hotel, Boston, Mass., at noon of Saturday, the 12th inst.

A. K. QUINN, Secretary.

[OFFICIAL NOTICE.]

Twenty-eighth Annual Meeting, New England Association of Gas Engineers.

OFFICE OF THE SECRETARY, LYNN, MASS., Feb. 3, 1898.

The twenty-eighth annual meeting of the New England Association of Gas Engineers will be held at Young's Hotel, Boston, on Wednesday and Thursday, February 16 and 17, 1898.

The first session of the meeting will be called to order at 10 o'clock, Wednesday morning, February 16, for the election of new members, the address of the President, the reports of officers, the election of officers and the general business of the Association; following which will come the reading of papers and their discussion. The arguing of short topics, and other matter proposed for debate, will continue, until final adjournment, Thursday noon.

On Wednesday evening, at 6:30, the members will dine together at the hotel.

During the meeting the following papers will be read:

"Gasholder Construction," by Mr. H. A. Allyn, Cambridge, Mass.
"Desultory European Notes," by Mr. W. S. Allen, Boston, Mass.
"Some Incandescent Burners," by Mr. N.W. Gifford, New Bedford, Mass.
"The Winning Ways of Gas," by Mr. William McGregor, Pawtucket, R. I.

It is thought other papers will be read, and it is also expected that several "short topics for discussion," the subjects of which will, if possible, be announced before the meeting, will be presented.

Blank applications for membership can be obtained from the Secretary. Applications for membership, and all other matters for the consideration of the Directors, should be forwarded to the Secretary before Tuesday, February 15.

CHAS. F. PRICHARD, Secretary.

[OFFICIAL NOTICE.]

Fifth Annual Meeting, Michigan Gas Association.

OFFICE OF THE SECRETARY, SAGINAW, E. S., MICH., Jan. 11, 1898.

To the Members of the Michigan Gas Association: Gentlemen—You are hereby reminded that the fifth annual meeting of our Association

will be held on Wednesday, the 16th, and Thursday, the 17th, days of February next, at Port Huron, Mich.

The new Hotel Harrington has been selected as Association headquarters, with rates, for all rooms without bath, at $2.50 per day; with bath, at $3 per day. From experience at our recent meetings it would be well to have rooms reserved as early as possible.

The following papers will be presented for consideration:

"Experiments with the Welsbach Lamp," by Mr. Frank H. Hess.

"An Automatic Closed Purifier," by Mr. Henry G. Beatley.

"Our Patrons: How to Treat Them," by Mr. S. Milo Dole.

"The Utilization of Coal Tar by Distillation," by Mr. Edward J. Ellis.

"Reminiscences," by Mr. Robert Calhoun.

Mr. Fred. J. Howden will also present a paper, the title of which is not received. Respectfully yours, HENRY H. HYDE, Secretary.

BRIEFLY TOLD.

THE TWENTY-EIGHTH MEETING OF THE NEW ENGLAND ASSOCIATION.—Secretary Prichard this week puts before the members of the New England Association of Gas Engineers the programme for their 28th annual meeting; and an examination of it provides proof that the New Englanders are still working along the lines of harmony which have made the Association that which it is—a body representative of the best gas engineering practice of the day in America. The paper list promises well, for the named subjects have much in them to educe thought and to provoke discussion. President Fowler, Secretary Prichard and the Board of Directors have left nothing undone that could have been done in a preliminary way to insure the success of the meeting, wherefore it is safe to count on an attendance, in Young's, next week, that will have the health which goes with numbers. It might be well to secure accommodations in advance; and it is a necessity that those having subjects for the consideration of the Board of Directors should heed Secretary Prichard's hint that the same be in hand of the Board, prior to the 15th inst.

TWO CHAPTERS IN THE ARRANGEMENTS FOR THE FORTHCOMING MEETING OF THE WESTERN GAS ASSOCIATION.—A fortnight ago we reported that the Board of Directors of the Western Gas Association, as a result of personal investigation by the members of its Executive Committee, of the availability of Mount Clemens, Mich., as the place for holding the next meeting of the Association, would likely decide to name Detroit instead of the Mount. By formal vote, the Directors have unanimously agreed to the substitution; and we are certain that all the members will coincide in the decision. So much for the first chapter. The second chapter relates to an official notice from Secretary Dunbar, which in substance is that Mr. E. H. Jenkins, the Editor of the Western's "Wrinkle Department," earnestly appeals to those contemplating contributions to this exceptionally useful and entertaining division of the Association's technical programme for the speedy coming-to-hand of that they propose to submit. Any device, that has or seems to have merit, worth a trial in a gas works, is fit for description, and those who have "put in time" with such device are asked to jot down their experience for the benefit of their fellows. "Wrinkles" should be in Editor Jenkins' hands by March 20th, so that he may have fair length of time in which to smooth them for exposition in Detroit during May. Communications on this account should be addressed to him, care of the Buffalo City Gas Company, Buffalo, N. Y.

NOTES.—Mrs. Helen Armstrong, whose card announcing her desire to accept engagements during the coming season, in the instance of demonstration lectures on cooking by gas, appears in another column, is quite well up to her work. Her references are of the best.——Mr. George C. Holberton, well known to the gas fraternity of the Pacific Coast, through his former connection with the gas interests of San Francisco, was united in marriage, on the 16th November, to Miss Katherine Johnson, the ceremony having been had in the residence of Dr. Heyward-Hays, Bangkok, Siam. Mr. Holberton has for some time been Chief Engineer of the Bangkok electric lighting syndicates. Good luck to them.——The proprietors of the Greenfield (Mass.) Gas Company have declared a dividend of $1.50 per share on the preferred stock, and a dividend of $1 per share on the common stock.——At the annual meeting of the shareholders of the Manchester (N. H.) Gas Company these officers were chosen: Directors, Moody Currier, C. F. Warren, Geo. B. Chandler, W. M. Parker and N. P. Hunt; President, Moody Currier; Clerk, N. P. Hunt.

[From the *Journal of Gas Lighting.*]

The Incorporated Institution of Gas Engineers and the Standard of Light.

First Report of the Committee on the Proposed Standard of Light and the Temperature of Gas Measurement.—It will be remembered that at the annual meeting of the Incorporated Institution of Gas Engineers in May, 1896, a Committee, consisting of Messrs. A. Colson, C. C. Carpenter, C. Hunt, F. Livesey, J. Methven, R. O. Paterson, G. C. Trewby and L. T. Wright, was appointed to "investigate and report at a subsequent meeting upon the proposed standard of light and the relation of gas measurement to temperature." The Committee, of which Mr. Hunt is the Acting Chairman, have issued their first report, and we have received a copy from the Secretary of the Institution (Mr. T. Cole). It is signed by all the members with the exception of Mr. Lewis T. Wright, who, having left the Institution, relinquished his place upon the Committee. The following is the text of the report:

Your Committee report that at their first meeting, held on June 11, 1896, all the members being present, it was resolved that independent experiments with the 10-candle Dibdin standard should be made by members of the Committee, five of whom undertook this work. Their experiments are distinguished in this report by the letters A, B, C, D and E.

The claims made on behalf of the proposed standard, and the objections urged against it, are tabulated as under:

Claims for the Standard.	*Objected by Mr. L. T. Wright.*	*Objected by Mr. J. Methven.*
1.—That it is of the value of 10 standard sperm candles.	....	That it is 3 to 5 per cent. too high in value.
2.—That the standards can be made practically identical with one another.	That the standards vary in value with the situation in which they are used; the simple transposition of a standard from one side to the other of a photometer may greatly alter its value.	
3.—That the value of the standard is unaltered when its flame varies from ¼ inch below to 1¼ inches above the prescribed height of 3 inches.	That the light from the standard is seriously affected by variations in the height of flame.	That a 3-inch flame should at all times be used, any variation altering its amount of light value. (Letter to C. Hunt.)
4.—That coal gas may be substituted for air as a carrier of the pentane vapor without alteriug the value of the standard.	That coal gas cannot be accepted as the equivalent of air as a carrier of the pentane vapor.	
5.—That the value of the standard is unaffected by change of temperature.	That the light is seriously affected when the temperature of the carbureter approaches 90° F.	That with a variation of 22-23 degrees in temperature there is a difference of 13½ per cent. in the amount of light emitted.
6.—That the depth of pentane in the carbureter may be anything from ¼ inch to 2.4 inches without affecting the value of the standard.		
7.—That if care be not taken in the selection and the centering of the chimneys, a slight error of perhaps 2 to 3 per cent. is possible.		That the same portion of the chimney should always be placed between the flame and the screen. (Letter to C. Hunt.)

Mr. Methven also suggests that 20 minutes should be allowed to elapse after the adjustment of the position of the standards in the photometer before commencing readings—a condition which was observed throughout the experiments which are herein summarized, as was also his suggestion that the same portion of the chimney should be placed between the flame and the screen.

Claim 1.

It has appeared to your Committee that the first question to be determined is the variability or otherwise of the standard as a standard of light; but experiments extending over 12 months have been made by one member of the Committee, which prove that the Dibdin standard No. 586 returns a lower value for the gas by about 9-10ths of a candle than was obtained from candles used with the same photometer.

Claim 2.

An investigation of this claim has been the object of a large number of experiments; each operator being furnished, partly by a system of interchange, with three or more certified standards. Thus A having two standards, borrowed a third from E, returning this on completion of his experiments, and lending one of his own to B; B in turn lending one of his to C; and so on.

A.

Each result is the mean of 30 observations made by three observers, each making ten.

Burner 219 tested by burner 220 gave 10.24 candles.
" 219 " " 202 " 10.31 "
" 220 " " 219 " 9.81 "
" 220 " " 202 " 10.00 "
" 202 " " 219 " 9.99 "
" 202 " " 220 " 10.22 "

Taking 202 as the light of comparison } 219 : 220 :: 10 : { 9.77 when the standard of comparison was placed at the left terminal of the bar. 9.70 when at the right.

Taking 220 do..... 219 : 202 :: 10 : { 9.81 when the standard of comparison was placed at the left terminal of the bar. 9.98 when at the right.

Taking 219 do..... 220 : 202 :: 10 : { 9.93 when the standard of comparison was placed at the left terminal of the bar. 10.18 when at the right.

Showing a maximum difference of 0.30 candle, or 3 per cent., between two standards. A series of six experiments made to ascertain the effect of changing or reversing the carbureters gave a maximum difference due to this cause of 1½ per cent.

B.

In these experiments, four certified standards were used, and each was compared with the others at both ends of the photometer bar. Thus standards 227 and 219 were first compared—227 on the right and 219 on the left; 219 was then replaced by 213, and the latter by 224. The standard on the right—viz., 227—was then replaced in turn by 219, and in turn by 213; followed by the substitution of 227 and 219 in place of 224 on the left; and so on.

Taking as the light of comparison—	Standard of Comparison at the Left of Bar. Relation of		Standard of Comparison at the Right of Bar. Relation of	
219.....	227	213 & 224	227	213 & 224
	is, as 10.00 :	9.82 : 10.25	is, as 10.00 :	9.93 : 10.12
213.....	227	219 & 224	227	219 & 224
	is, as 10.00 :	10.00 : 10.04	is, as 10.00 :	10.27 : 10.17
224.....	227	219 & 213	227	219 & 213
	is, as 10.00 :	10.07 : 9.81	is, as 10.00 :	10.01 : 9.83
227.....	224	219 & 213	224	219 & 213
	is, as 10.00 :	10.12 : 9.74	is, as 10.00 :	10.06 : 9.85

Showing a maximum difference of 0.43 candle, or 4.3 per cent. Each figure in the above table represents an average of two or more tests of ten observations per test.

Experiments were also made to determine the value of the standards by the method of substitution when using two carbureters only for the whole series of experiments. These were fixed at the terminals of the bar, and the standard placed upon them in succession as before described.

Taking as the light of comparison—	Standard of Comparison Placed at the Left Terminal of Bar. Relation of		Standard of Comparison Placed at the Right Terminal of Bar. Relation of	
219.....	227	213 & 224	227	213 & 224
	is, as 10.00 :	9.95 : 10.04	is, as 10.00 :	10.02 : 9.97
213.....	227	219 & 224	227	219 & 224
	is, as 10.00 :	10.19 : 10.10	is, as 10.00 :	10.03 : 9.90
224.....	227	219 & 213	227	219 & 213
	is, as 10.00 :	10.16 : 9.91	is, as 10.00 :	9.97 : 9.82
227.....	213	219 & 224	213	219 & 224
	is, as 10.00 :	10.32 : 10.03	is, as 10.00 :	10.09 : 9.92

Showing a maximum difference of 0.32 candle, or 3.2 per cent., between two standards.

In the above experiments it was observed that two standards when compared did not give from day to day the same results, although the results obtained on each occasion were in close agreement. Careful research has failed to discover any external cause for such variations. Thus, when 227 and 219 were compared, 227 on the right and 219 on the left, the following variations in the light value of No. 227 were observed on four different occasions:

(1) 9.80, 9.85, 9.89, 9.85 and 9.87.
(2) 10.05, 9.97, 9.98, 9.91, 9.96 and 9.98.
(3) 9.80, 9.84, 9.82 and 9.89.
(4) 10.05, 10.09 and 10.02.

Showing a maximum variation of 2.9 per cent.

C.

Taking 213 as the light of comparison. } 222 : 221 :: 10 : { 9.72 when the standard of comparison was placed at the left terminal of the bar. 9.69 when at the right.

Taking 221 do..... 222 : 213 :: 10 : { 9.53 when the standard of comparison was placed at the left terminal of the bar. 9.65 when at the right.

Taking 222 do..... 221 : 213 :: 10 : { 9.78 when the standard of comparison was placed at the left terminal of the bar. 9.95 when at the right.

Showing a maximum difference of 0.47 candle, or 4.7 per cent.

D.

Taking 586 as the light of comparison. } 222 : 223 :: 10 : { 9.84 when the standard of comparison was placed at the left terminal of the bar. 9.85 when at the right.

Taking 223 do..... 222 : 586 :: 10 : { 9.99 when the standard of comparison was placed at the left terminal of the bar. 9.99 when at the right.

Taking 222 do..... 223 : 586 :: 10 : { 10.24 when the standard of comparison was placed at the left terminal of the bar. 10.22 when at the right.

Showing a maximum difference of 0.24 candle, or 2.4 per cent. The results obtained by interchanging the carbureters were practically the same, indicating that no difference occurred with different carbureters.

E.

Taking 217 as the light of comparison. } 202 : 223 :: 10 : { 9.77 when the standard of comparison was placed at the right terminal of the bar. 9.73 when at the left.

Taking 202 do..... 217 : 223 :: 10 : { 10.27 when the standard of comparison was placed at the right terminal of the bar. 9.99 when at the left.

Taking 223 do..... 202 : 217 :: 10 : { 9.70 when the standard of comparison was placed at the right terminal of the bar. 9.91 when at the left.

Showing a maximum difference of 0.30 candle, or 3 per cent. A series of experiments made to ascertain the effect of changing the carbureters of the standards, gave a maximum difference due to this cause of 1 per cent.

Taking the averages of the experiments included in the foregoing summaries, it may be calculated that if standard No. 213 be of the value of 10 candles, the remaining standards will possess the following values:

213	219	227	224	220	202	221	222	223	586	217
10.0	10.26	10.15	10.26	9.99	10.15	10.14	10.43	10.26	10.42	10.03

Claim 3.—B.

Value of one of the Standards when the Flames of both were Maintained at the Normal Height.	Value of the Same Standard when its Flame was Maintained ½-Inch Low.	Error Due to to Lowering of Flame.	
9.92	9.31	—0.61	
10.04	9.72	—0.32	
9.54	9.24	—0.30	Standard supplied with gas instead of air.
10.15	9.77	—0.38	
9.91	9.51	—0.40, or 4 per cent.	

	Value of the Same Standard when Its Flame was Maintained ¼ Inch to 1 Inch High.	Error Due to Raising the Flame.
9.92	9.97	+0.05 ¼-inch high.
10.04	10.02	—0.02 do.
9.54	9.41	—0.13 Standard supplied with gas (flame 1 in. high).
10.15	10.16	+0.01 do.
9.91	9.89	—0.02, or 0.2 per cent.

E.

			217	223
217 flame about ¼ inch low....	223	flame about ¼ inch low	1	1.025
		" normal	1	1.020
		" about ¼ inch high	1	1.015
217 " normal	223	" " " low	1	1.025
		" normal	1	1.020
		" about ¼ inch high	1	1.020
217 " about ¼ inch high....	223	" " " low	1	1.030
		" normal	1	1.030
		" about ¼ inch high	1	1.025

Claim 4.—B.

Value of One of the Standards when both Standards were Supplied with Air.	Value of the Same Standard when Gas was Substituted for Air in its Case.	Error Caused by Supplying Gas to One Standard.
9.94	9.53	—0.41
9.99	9.54	—0.45
(Average of two experiments.)		
9.84	9.42	—0.42
(Average of four experiments.)	(Average of two experiments.)	
10.20	10.04	—0.16
(Average of two experiments.)		
9.86	9.76	—0.10
9.99	9.82	—0.17
10.25	10.01	—0.24
10.01	9.73	—0.28, or 2.8 per cent.

Claim 5.—B.

The carbureters of two standards were immersed in water baths and left for about an hour, when their lights were compared. By increasing the temperature of one carbureter, the temperature of the other carbureter remaining as before, the value of the standard was found to be reduced.

Claim 7.—B.

A great number of experiments were made to ascertain to what extent, if any, the placing of different portions of the chimney between the flame and the screen affected the value of the standards. These showed that with three of the standards used in the experiments no material variation resulted from changing the chimney or placing different portions of them between the flame and the screen. Using, however, the fourth (224) standard with the chimney in any other position but that with its trademark at the back of the flame, and employing the method of substitution, the maximum difference in value between the standards was increased from 4.2 to 6.6 per cent.

Summary.

It appears from the experiments made by your Committee that—

1. The proposed standard is of greater value than 10 standard sperm candles, and two such standards may differ considerably in value, which difference may be materially increased if special care be not taken in the selection of suitable chimneys for the burners. Also, two such standards when compared do not give from day to day the same results, nothwithstanding that results obtained at any one time may be in very close agreement.

2. The light value of the proposed standard varies when the standard is removed from one end of the photometer bar to the other. The light value is also altered when the normal height of flame is not maintained, and is affected by change of temperature.

3. Coal gas cannot be substituted for air as a carrier of the pentane vapor without altering the light value of the standard.

4. Serious variations in the light value of the standard may result from the want of special care in the selection of the chimney, which not only requires to be standardized with the burner, but to be always used in the same relative position as regards the disc.

CHAS. HUNT, Acting Chairman,
CHAS. C. CARPENTER, FRANK LIVESEY, R. O. PATERSON,
ALFRED COLSON, JOHN METHVEN, G. C. TREWBY.

Dec. 1, 1897.

[Prepared for the JOURNAL.]

History of Nitrogen in Coal.

By MR. HERMAN POOLE, F.C.S.

A piece of ordinary gas coal, analyzed by the customary methods of ultimate organic analysis, yields carbon, hydrogen, oxygen, sulphur, nitrogen, and a quantity of incombustible residue called ash. This method of analysis reveals nothing as to the actual constitution of the coal, nothing that will tend to elucidate the mystery as to what coal is made of, or how it is made. It simply shows that, under the conditions of the analysis, those elementary bodies are found to be present.

Is the carbon of the coal in the condition of carbon, or is it combined with hydrogen or oxygen? Is the nitrogen combined with the hydrogen or the carbon, or both? Is it in a stable compound, or is it in one of those unstable forms in which it is usually found? These and similar questions are often asked and not yet answered.

To attempt an answer to these questions the method of proximate organic analysis was introduced. This method consists in so acting on the coal that certain compound substances are formed, which contain the above elements in different proportions and have certain special characters of their own; but this does not solve the problem.

For instance, one of the products of ultimate analysis is a compound of nitrogen called cyanogen. It is found as hydrocyanic acid or as ammonium cyanide; but did anyone ever actually obtain hydrocyanic acid from coal direct without using destructive distillation? Has it ever been shown to exist in coal which had not been acted on by heat? The same can be said of most all of the other substances found by the ultimate analysis; few of them having been obtained from coal by any other means.

To recount some of the sources of the nitrogen in coal and to trace its history through its various changes are the objects of this article.

To determine how nitrogen came to be a constituent of coal it is necessary to go back in its history a few thousands, or a few millions, of years, to the days when the plants from which it came were flourishing. In these days the air was somewhat different from that of our time. There was a much greater quantity of moisture in it, and the ammonia, carbonic acid and other impurities were in larger amounts. In this air lived certain plants of the families called ferns and lycopodiums. They grew and waxed under the influences then at work, and attained a size unknown in our days for the same families of plants. Finally they became old, fell, and their places were occupied by others. Our coal is now in its first stage—wood.

Wood consists substantially of cellulose and an incrusting substance varying in different kinds, but always containing more carbon and hydrogen than cellulose, and, in addition, considerable nitrogen. The analysis of a few kinds of wood, according to Chevandier, will show the composition of the future coal:

	Carbon.	Hydrogen.	Oxygen.	Nitrogen.
Beech.....	49.89	6.07	43.11	0.93
Oak.....	50.64	6.13	42.05	1.28
Birch	50.61	6.23	42.04	1.12
Aspen.....	50.31	6.32	42.39	0.98
Willow.....	51.75	6.19	42.08	0.98

Young wood and twigs contain more nitrogen, due to the large amount of formative tissue. In the above woods these amounts are as follows:

Beech, 1.08; aspen, 1.05; willow, 1.48.

Other portions of the plant contain larger quantities of nitrogen, the bark of the cork oak containing 1.50 per cent., while some of the seeds contain from 8 to even 20 per cent.

The probability is very strong that the trees of the carboniferous period contained a large amount of nitrogen. Dr. T. Sterry Hunt published the analysis of some of the coal plants of Nova Scotia and reported 8.73 per cent. of nitrogen in lycopodium. A large number of the plants of that time were of this family.

These trees, dying and accumulating, formed a vast deposit of vegetable matter which in time became analogous to our peat. This is woody fiber on its way towards coal, partially changed by the abstraction of oxygen and hydrogen and also some nitrogen. Its composition may be represented by:

Carbon.....	61.7 per cent.
Hydrogen.....	6.0 "
Oxygen.....	31.0 "
Nitrogen.....	1.3 "

Some of the Irish peats have as much as 3.25 per cent. of nitrogen, but this is more than the average.

In process of time the peat becomes covered up and gradually changed to the next great division—lignite, or brown coal, as it is called in some localities. Between this and peat all gradations have been found; some are so close to the line of distinction that they are classified differently by different authors.

In lignite the vegetable matter has undergone still further changes, and the carbon content becomes higher, while the oxygen and hydrogen have become less. Part of the nitrogen has also disappeared under the combined action of the forces to which it has been submitted. The composition of lignite varies considerably, but this will answer for a sample:

Carbon	66.65 per cent.
Hydrogen	5.57 "
Oxygen	22.65 "
Nitrogen	0.90 "
Sulphur	2.00 "
Ash	2.23 "

Lignite passes gradually into coal, of the kind called soft or bituminous. It contains no bitumen, and it is doubtful if any ever found did contain enough to merit the name. But we all know it means the soft coal—the coal that gas men are interested in.

In coal the oxygen and hydrogen are in less quantity still, and, of course, the carbon higher. The nitrogen has not undergone much, if any, change; its proportion seems to be fixed. An analysis of a bituminous coal will show:

Carbon	80 per cent.
Hydrogen	8 "
Oxygen	10 "
Nitrogen	2 "

The nitrogen percentage varies considerably—in some it is as high as 5 per cent.; but this is exceptional.

It will be noticed that through all the changes the small percentage of nitrogen resists successfully the influences which gradually remove the oxygen and hydrogen. True, there is less than was in the orignal plants, but its proportion is much greater now, compared with what it was, than is that of the oxygen and hydrogen. The only explanation of this possible, is that it is combined in some stable combination, which the ordinary efforts of nature do not decompose. What the compound is is one of the problems to be solved; but there seems to be no doubt of its existence.

Before the peat stage the nitrogen compounds were not very strong; they were easily decomposed, and part of it became dissipated in the air to help in the formation of new plants. That this is so we know of our own knowledge of the nitrogenous compounds that we find now in wood and the rest of the organic world. All are easily decomposed, and many of them are so constituted that they act as agents of decomposition for other substances associated with them.

In process of time, probably under a continuation of the same influences, a still further change occurs, and the gradations through semi-bituminous, anthracite, anthraxolite and graphite are reached. In each there is a gradual lessening of the oxygen and hydrogen, and to some extent of the nitrogen also. Analyses show this plainly enough:

	Semi-Bituminous.	Anthracite.	Graphite.
Carbon	84.75	94.00	97.50
Hydrogen	5.75	2.75	1.25
Oxygen	8.00	1.75	0.75
Nitrogen.	1.50	0.75	0.50

For our investigation, however, of the history of nitrogen, we stop in this sequence when we reach bituminous and gas coal. Thus far the operations have been carried on in nature's laboratory—a very large one and a sure one; but, at the same time, one in which years do not count. But now the theater of operations will be transported to man's laboratory, and to that type thereof called the gas works.

Here the coal is taken up and, by means of the action of heat in retorts, subjected to a quick and complete decomposition. The elements have been gradually arranged according to certain laws operating at moderate temperatures, now they obey laws operating at high temperatures. As a result, a large number of new substances are found, solid, liquid and gaseous; all of them are not invariably formed with the same coal, but vary in number and proportions with the conditions at the time.

There is no need of recounting the hydrocarbons, the olefines, the benzols, the cresols, etc., formed or possible. The nitrogen compounds are sufficient, and we shall find quite a number of these. All the nitrogen of the coal is not distilled off; quite a percentage remains in the coke. Thwaite found 64 per cent., and Foster reports 49 per cent. in coke from Durham coal.

The portion left in the coke must be in combination with some metallic base capable of successfully resisting the heat. The base is probably potash or soda, perhaps both; and possibly another similar base, as calcium. Coal ash contains these bases, and usually in the form of carbonates, showing that the cyanides might have been produced under favorable circumstances.

A portion of the nitrogen passes off uncombined; part of it combines with hydrogen to form ammonia; part with carbon to form cyanogen; part with carbon and hydrogen to form hydrocyanic acid, ammonium cyanide, sulphocyanide, etc. There are also formed in the part which forms the tar, aniline, acetonitril, pyridine, carbazol, leucoline, pyrrol and their allies and homologues, etc.

The number of nitrogen compounds found and described in coal distillation products is at least fifty, probably more; but, of course, many of these occur in very small quantities, and are of no present interest except to the theoretical chemist. To the gas manager they are all known under the collective name of tar.

The nitrogen contained in the coke remains in the retort; that contained in the tar passes on and is collected in the hydraulic main, the coolers and condensers (let us hope it goes no further); that contained in the ammonia is collected in the ammoniacal liquor and sold as such, or made into sulphate; that which forms cyanides passes on to the purifiers, becomes fixed there, and in some locations is extracted and sold.

To give an idea of the proportion of nitrogen in the different commercial products I subjoin the following analysis made by Foster on Durham coal tar. The coal contained 1.73 per cent. of nitrogen.

The products contained:

Ammonia	14 50	per cent. of the amount in the coal.
Cyanogen	1.56	" " " "
Free nitrogen	35.26	" " " "
Coke	48.68	" " " "
	100.00	

The yield of cyanogen will be seen to be very small; many others have exceeded this. Great differences are found in the ratios of ammonia, cyanogen and free nitrogen, according to the heat employed, the percentage of moisture and the quantity and nature of the ash. High heats tend to increase the cyanides, large quantities of moisture increase the formation of ammonia; and alkaline ash has a tendency to increase the ammonia content, possibly by removing the cyanogen.

Of the principal products produced from the tar the nitrogen percentage is as follows:

Crude benzene (benzol)	2 33	per cent. of nitrogen.
Light oil	2.19	" "
Creosote oil	2.01	" "
Red oil	2.19	" "
Pitch	1.60	" "

And London tar yields, of—

Benzene	1.1 per cent.
Light oil	2.4 "
Creosote oil	33.2 "
Pitch	59.0 "

Of the nitrogen contained in the coal originally, under the methods now in vogue, we throw away all that is in the coke, all that is in the tar, all that goes off as gas, all the cyanide nitrogen, and barely save that of the ammonia.

So, that if a coal has 1.5 per cent. of nitrogen, we *throw away*—

In the coke	0.635 per cent.
" tar boiling	0.160 "
" cyanides	0.100 "
Give away—	
In the pitch	0.244 "
Lose as gas—	
Free nitrogen	0.200 "
Sell—	
In ammonia	0.217 "
	1.500 "

which means that we do actually receive benefit from 14.5 per cent. of the nitrogen originally present in the coal. Let us hope this statement will need modification before long.

Action of Sulphuric Acid on Coal Gas.

Mr. P. Fritzsche, in the *Jour. Prac. Chem.* (Germany), remarks that brown substances, ranging in consistency from resin like solids to limpid oils, are formed when coal gas is washed with concentrated sulphuric acid. Berthelot (*Comptes Rend.* 82, 871) obtained 25 grms. of such condensation products from 100 cb. m. of Paris gas, and thence isolated six bodies of an aromatic nature, apparently formed by con densation of the molecules of methyl, dimethyl and propyl-acetylene. The acid would therefore appear to exert only a contact action on the hydrocarbon, but the author found the volume of the products scarcely diminished when substituted acetylenes were removed from the gas by means of ammoniacal cuprous chloride prior to the washing with acid. Therefore Berthelot's explanation can only apply to a small part of the condensation products. Moreover, the quantity and nature of the products vary with different samples of gas. The author obtained from 5—15 grms. per cb. m. of gas. A portion was dissolved by water, forming a green solution; and, after washing the remainder with solution of potash, about three-fifths of the whole was susceptible of distillation, and passed over steadily between 100°—300° C. Several kilos. were prepared by treating coke oven gas—freed from benzol and sulphureted hydrogen—with sulphuric acid under 5 atmospheres pressure. The brown oil which remained after some crystals had deposited was washed with slight excess of caustic soda, and the saline solution was separated from oil and concentrated. On cooling, white scales of silky luster were detected in the dark brown pulp, and by repeated extraction and crystallization this white salt was separated. From it other salts were prepared. The chief characteristics of the salts were as follows:

The copper salt $(C_{15}H_{29}SO_4)_2Cu+6H_2O$, prepared from the sodium salt and copper sulphate, is pale blue, but, when dehydrated, pale green. The salts of the alkalies lather freely, and dissolve phenols to clear non alkaline solutions. The ammonium salt, $C_{15}H_{45}SO_4+2H_2O$, is in needles of silky luster, readily soluble. The sodium salt, $C_{15}H_{29}SO_4Na+6H_2O$, forms efflorescent plates, less soluble than the ammonium salt, and fuses only with decomposition. The alkaline earths give salts with difficulty soluble in cold, more readily in hot water. The ferrous salt $(C_{15}H_{29}SO_4)_2Fe+7H_2O$ is white—yellowish in a moist atmosphere. This salt separated in crystals from the original condensation product, the iron having been derived from the containing vessel.

The acid was prepared by passing sulphureted hydrogen through water containing the copper salt in suspension and removing the copper sulphide. It formed white crystals, readily soluble, and was very stable, being unattacked by hot concentrated sulphuric acid, and liberating hydrochloric acid from a hot solution of common salt. In this respect it resembles the sulphonic acids derived from the camphors, and it appears to be the sulphonic acid of a body having the formula $C_{15}H_{30}O$, which is also that of cedar camphor.

Other acids of a similar nature appear to be present in the condensation products of gas. The mother liquor of the above sodium salt contains at least one other acid, probably several acids, of which the salts are more freely soluble. On distilling the clear brown oil remaining after washing the condensation product with alkali and water, a crystalline white body was obtained at 200°—220°, but was not examined. The distillate oils boiling below 200° were limpid, and left a grease spot on paper; those boiling between 200° and 300° resembled mineral oils. The hydrocarbon residue in the retort cooled to a brown resin. Clearly, the products of the treatment of coal gas with sulphuric acid are by no means so simple as Berthelot supposed.

Electric Lighting for Profit.

[A paper read by MR. ALEXANDER DOW before the Northwestern Electrical Association.]

This subject is one which every member of this Association has studied, and concerning which every member must have opinions. I have selected it for the paper which your Secretary asked me to present at this meeting, because I have opinions of my own which I think may be of interest to other electric light men, and which I want to hear discussed and criticized and contradicted by you who are qualified by experience to do so.

I submit as the first proposition that we are all in business to make a profit. I don't expect to be contradicted on that proposition, although some may wish to so amend it as to indicate that they are at present content if they can avoid a loss. As a second proposition I submit that the conditions of the electric light industry have so changed in the last few years that the opportunities of profit are limited; that the margin between earnings and expenses tends to vanish, and can only be kept in view by unceasing endeavors to increase the one and reduce the other. The days have departed when a neat dividend could be paid on a small business done at high prices; and now, if a dividend is to be paid at all, it must be earned by doing all the business that can be obtained and at prices set but little above the actual cost of production. As the preceding statement forms the text of this discourse, I ask your attention to its repetition, as follows: I believe that the proper policy of electric light management under the conditions of the present time is to sell electric energy to every accessible user, in any shape that the user requires, and at the lowest price which will pay a reasonable profit on the capital invested.

Those of you who were in the business at its beginning will recognize in this profession of faith the converse of the rule which then governed us. We used to believe in a "System," and the people who taught us to so believe charged us so much for the experience and the incidental machinery which we required that we in turn had to collect great prices for the product sold to our customers. The rule was to get out of the business all that it would stand; and if a possible customer did not like the particular kind of energy which our "System" furnished, and thought he would like the kind which some other alleged system was supposed to produce we considered him a heretic. Electric light was then a novelty and a luxury and a mystery, and was to be respected and paid for accordingly. Nowadays it is a thing of domestic use; the machinery for its production is sold as freely as any other machinery; the principles governing its distribution are taught to all who desire to learn, and its supply is recognized as a customary or even necessary public service exactly as is the supply of gas and water. It is proper that we should announce a policy suited to the new condition. That many have done so, and also that some have long been governed by just such a policy as I advocate I know, but there still remains, to the detriment of the business at large, some who are trying to run their affairs on the old plan. They do not profess to do so, and if challenged they may plead the old excuse—that the cost of their plant and the losses incident to its first operation have been so great as to require high prices for the energy sold. That excuse is not valid in these latter days. Taxing customers all they will stand means competition either by an opposition plant or by the municipality, and either of these means ruin to the station which is run on the old lines.

Of course, I do not intimate that any member of this Association is managing his business to-day after the fashion of the eighties. But each of us knows of some plant in the next town to ours which is run just that way. That plant is going to fight it out on the old line until it is wiped out by a municipal plant, and the municipal plant will publish a report to the whole United States that it has reduced the price of lighting 30 or 40 per cent. Then you and I and each of us is going to have the trouble of explaining at great length to our own particular municipal authorities why a municipal plant established in our town cannot possibly make any similar reduction.

The man who used to sell experience to us is probably to day trying to show the ambitious city fathers of that other town next to ours how well they can serve their constituents, and how much honor they can obtain from society at large by engaging their municipality in the electric lighting business. Our friend, with experience to sell, is not one bit more exact in his statements than he used to be long ago, and we cannot honestly say that his operations are beneficial to our business, but he is less detrimental than the man who gives him a chance to get in his work, the man who ought to be giving good service to a satisfied constituency, but who is furnishing lights that are a disgrace to the "System" and its owner, and trying to collect higher rates than those at which you and I are giving first-class service to our public.

What is a reasonable profit? This is a much discussed question. The man in the next town believes that a reasonable profit is everything he can get, and at the other extremity of belief is the man who holds that no public service should pay a profit to any individual. Between these limits will be found the opinions of the great majority of Americans, whose democratic training has taught them that the commonwealth should not undertake any work which can be satisfactorily performed by private enterprise. Those members of this great majority who have money invested in manufacturing or in commerce recognize that a reasonable profit means something more than can be obtained by the investment of their funds in Government bonds or by placing them in a savings bank, and yet something less than is hoped for when the investment is of a speculative character, involving risk of total loss of

capital, such as the exploiting of a new mine or the insurance of an overdue vessel and its cargo.

I believe that after operating expenses are paid and any deterioration of the investment shown by a carefully made inventory has been made good, a dividend such as is paid by a good manufacturing business is reasonable for electric lighting. Such a dividend will necessarily vary with the line of manufacture, those concerns who manufacture a staple having a practically constant market being satisfied with a narrower margin of profit than those others where the production has to be varied from time to time, and new markets developed at intervals.

The same considerations govern in the electric lighting business. A station which is well established, has no ruinous competition to meet, is not threatened by municipal interference, and is not obliged to continually risk money in extensions of an uncertain character, may well pay a dividend but little in excess of the current rate of interest in savings banks. The station in which all these conditions are reversed, particularly when there is a prospect of its investment being wiped out by causes which its management cannot control, is entitled to a greater return.

There is much work to be done in the education of the public to a proper understanding of the economic principles underlying this subject. The citizen who has theories about municipal service does not apply these to his own affairs, nor will he apply to his theories the rules which govern his personal practice until you show him that this should be done. He thinks it no harm that he should draw from the capital invested in his own business 10 or 15 or 20 per cent. in addition to a fair salary for management and any loss that is shown by annual inventory. He thinks it entirely proper that he should build up a business worth much more than its nominal capital by returning into it a large annual surplus. But he will denounce as extortionate an electric lighting company which pays a good deal less than 10 per cent., and for such a company to show a surplus is in his eyes prima facie evidence of robbery of the public. He, on the one hand, refuses to protect the public service corporation from unlimited competition, and on the other hand demands that it do business for a rate of profit accepted only on the safest class of investment bonds.

In Europe they are more logical. They limit the price which a company may charge to its customers and the dividend which it may pay to its stockholders. They require the company to give good service to all who demand it within a certain area. But at the same time they permit no competitor to enter the same district, and they provide for the purchase of the property at a reasonable price in the event of the franchise not being renewed at its expiration. Where they restrict they also protect. Our theorists have yet to learn that these two actions should go together, and it seems to be our affair to teach them this lesson.

There has been of late much discussion of the subject of rates at conventions and in the electrical press, and with good reason. American practice has heretofore been to make rates without sufficient analysis of cost, and particularly without attempting to make each unit of energy sold bear its proper share of the standing charges of the plant. Premising that we are to readjust rates for a minimum profit, we must do so according to a carefully considered system. It will not do to make a horizontal cut on the present schedules because analysis will show that some business now done at the highest rate is not profitable and a reduction of rate should only be made on business that is profitable.

It has been said that American customers insist on a uniform rate—a "one price American plan" method of charging. I do not find it so. I have no difficulty in explaining to those customers whom I meet why some business should pay a higher rate than other business, and other electric light men tell me that, after they have got the principles involved clearly defined in their own minds, their experience with customers is similar to mine.

The base of any system of rate making must be analysis of the costs of production. The method of analysis which I have found most useful is that proposed by Mr. Arthur Wright. The paper read by that gentleman at the last meeting of the National Association is doubtless familiar to you, but as American conditions usually differ from those existing at Brighton it is seldom possible to apply the short method of estimating standing and running costs which Mr. Wright found convenient, and an analysis in detail must be made. I use the following method: Consider what the condition of the station would be if you were obliged to be ready to do the same business that you now do, and during the same time, but had no customers taking current. You would have fires lighted, men on duty, dynamos turning over, lines strung and connections made to customer's premises. You would burn enough coal to keep up steam and keep the dynamos in motion, and you would have enough help for these conditions. But you would not burn so much coal as if the machinery were running at full load, and you might need less help. Your lines would be out in the weather or buried in the ground, and that deterioration which is due to time and to climate would go on just the same and would have to be made good by a repair gang. But you would not need renewals of incandescent lamps or carbons, and you would not keep any men to put in fuses for customers or to read meters. You would need a manager and an engineer and an electrician, just as you do now, but you would not need a bill clerk nor a collector, and you might do without an office boy. My rule is to ask whether the item of expense under consideration would continue or would cease under the conditions described. If it would continue it is a standing charge. If it would cease it is a running charge. It is clear that taxes, insurance and interest are standing charges.

Mr. Wright has shown us that it costs us a great deal of money to get ready to serve a customer, even though the customer only requires service for a single hour in a year. This amount he calls the standing charge. He has pointed out that a uniform rate takes no account of this, but is apparently based on the assumption that it costs just the same to furnish current to a customer for one hour in the year as for each hour of 1,000 hours in a year. He argues correctly that in making rates we should take account of a customer's load factor, and he goes on to describe an ingenious method and an ingenious device invented by himself for taking such account. Whether we adopt this device or not we must all admit the correctness of his statement of the conditions governing costs of production, and we must, if we are hereafter to do business at a profit, make our rates with a due regard to these conditions.

To discuss in detail the whole theory and practice of rate making is beyond the scope of this paper. I advise each of you who has not already done so to make analysis of his costs in such manner as to distinguish between standing and running expenses. Using Mr. Wright's paper as a text book you will find (as I did) that the labor is well paid for by the results obtained. Properly tabulated these results will show what business is profitable at any given rate, or what rate should be made on any given business. My analysis showed me that I could afford to sell current to a large class of users at 4½ cents per unit, while a rate already established at $14\frac{4}{10}$ cents for another large class was not profitable. Now I am taking all the 4½-cent business I can find, and am letting other people hunt for the $14\frac{4}{10}$ cent kind.

The immediate business of an electric lighting station is to supply incandescent and arc lighting and power for stationary motors.

Some small plants limit their business to lighting, and thereby avoid operating during the daylight hours. I think that this is often done without good reason. There is in nearly every village some demand for power, or such a demand can be developed by an enterprising manager. It is likely that the rates to be obtained for power will be very low, but if they will pay the additional cost of running the station during the daytime and also carry some proportion of the standing charges these low rates may be profitable indirectly by reducing the amount of standing charges remaining to be earned by the lighting business. It is certain that interest, insurance and taxes run for 24 hours a day, although the plant may only operate for 12, and if the power load will pay half of these items in addition to the actual running cost it is worth having.

Some stations do not run all night. The people in the village where such a station is located may go to bed early, and may not use any appreciable amount of current after 11 o'clock or midnight. But I have always found it difficult to work up a good business in residence lighting unless the plant undertook to give all night service. Apparently customers do not care to have a duplicate lighting equipment in their residences. They do not fully appreciate the beauty of incandescent lighting if it cannot be switched on at any moment when it is wanted. People sometimes want lights between midnight and morning in their houses, and I suppose will continue to do so as long as our children come into this world with unreasonable ideas as to the part of the day in which they should do their sleeping.

I am sometimes told that residence lighting is unprofitable. It surely is if every residence that is served requires an independent transformer, and if only one residence in a dozen takes current at all. The only way to do residence lighting at a profit is to do all the lighting or nearly all that there is in a given residence district, and for this purpose the rate must be placed so that every possible customer can afford it. I have tried the experiment of low residence rates on a small scale more than once, and in each instance with success. It is to be tried now on a large scale in several stations, and I am certain that the experi-

ment will be successful. The load factor of residence lighting is much better than the average load factor of many stations.

It is a serious handicap to a station when it is obliged to run two or three separate types of dynamos and to maintain two or three separate distributing systems for the supply of different shapes of energy. The best practice to-day is to furnish incandescent lights, arc lights and electric motive power from the same dynamos and same mains. This is a subject to be considered in the original plan of the station, but there are instances where old stations have been rearranged with decided financial advantage. When a power load can be had even at the low rates already spoken of, a study of the local conditions should be made with a view to seeing whether a general distribution system will not be a source of profit. To design a new station with anything but such a system is almost criminal.

There has not yet been devised a satisfactory system whereby a supply of 500-volt current for railway work can be combined with a general lighting distribution. Therefore, a proposal that a lighting station should furnish such current must be dealt with as involving a new investment. This investment is always the cost of the dynamo and switchboard, and usually the cost of an engine. The street railway evening load in winter time coincides with the heaviest load on the lighting system for about 200 hours per annum. At all other hours the street railway demand is a desirable addition to the load on the boilers, and in most stations the dynamo and switchboard can be cared for without cost for additional help. If the boilers are properly designed to suit the conditions they may be driven beyond their usual rate during these 200 hours with greater profit than would be possible if additional boiler capacity had to be installed. Furnishing street railway current appears therefore to be equivalent to the sale of steam to a special engine and the furnishing of attendants to an additional engine and dynamo, and it should be considered as a business proposition on that basis and not in the same manner as a demand for current from the electric lighting plant.

If street lights can be served from a general distribution system, the rate should be made in the same manner as the rate for any other service from that system. As street lights usually run about 4,000 hours a year, a rate made on a scientific basis will be very low in comparison with the rate for ordinary commercial lighting. This is not in accordance with the old practice of making all the profit of the business on a street lighting contract, but it is distinctly in accordance with the more modern practice which will probably become general. Municipal contracts which can be performed without investment in special machinery are desirable business in that the payment is prompt and absolutely secure, and that the conditions of their performance are clearly laid down in the original agreement. For that reason the tendency appears to be to take such contracts at a very narrow margin of profit.

But when the performance of a street lighting contract requires an investment in special machinery and the building of special lines such a contract is usually undesirable business. It is impossible under present conditions to secure such prices for street lighting as will return the investment to the stockholders with the term of the contract. The contracts are usually short, and there is no security of their renewal. If, in dealing with a municipality, one were dealing with a business corporation having an established policy it would be justifiable to take such chances, but our American cities, if they have a policy at all, change it from election to election, and no contractor can tell that the service which was deemed perfect by the board with whom he made his contract will not be entirely unsatisfactory to their successors, with whom he must make a new contract two or three years hence. In this respect we have another lot of educational work cut out for us. If we could make it clear to the mass of our citizens that the price for a year's street lighting depended on whether the street lighting plant would be employed next year or would be standing idle, we might have some chance to make close bids without feeling that we were engaged in a risky speculation. The peculiarly exasperating part of the whole subject is that those same theorists who object to asking for bids on a contract running more than two or three years are usually ready to lock up the good money of the citizens in a city plant, which has to be security for 30-year bonds.

In these days of competition holding business after it has been attained becomes of the greatest importance. We have against us in every station some competition. In the larger cities we have to meet the offers of opposition companies doing a similar business to ourselves, the arguments of the man who wants to sell isolated electric plants to our best customers, and the ever present cheap service offered by the gas company. In the smaller towns and villages the worst obstacle to the holding of business is the tendency of our customers to economize by cutting down the amount of light used. This tendency is present also in the large cities, but is not so constantly in evidence because many city people must use light liberally in order to carry on their business. The whole law and gospel of holding business consists in getting your customers to believe that they receive good value for their money. It is not sufficient that you should believe it; you must convince the customers. But it tends to make your success more certain if you know in your own mind that you really are giving good value. For this reason it is essential that you know what each block of lighting costs, which brings up again the subject of analysis of expenses.

No matter how cheaply you offer to sell your products, it is essential that the customer is satisfied with what is delivered to him. Therefore, if he wants to use arc lights you must see that they are quiet and steady. If he buys current from you wherewith to operate a motor, you must make it your business to see that his motor runs satisfactorily. It is not a part of your contract to do this, but if the motor does not run as it should you will go up there some day and find that he has bought a gas engine. If you sell him current for incandescent gas lighting, you must see that the lamps are renewed before they become dim. If you cannot get the customer to buy new lamps, you would better arrange to furnish renewals free, as most stations now do. If even then your customer is slow about calling for renewals, you would better send one of your men up to change the lamps. Neglect in this respect probably means that there will be a sale of Welsbach burners in the neighborhood of that customer. You must be prepared to send assistance to him when he mixes things so that fuses get blown, and you must send this assistance promptly. This may mean that a man has to idle around the station for trouble calls, but you should not think that man's idleness gives you a chance to economize by discharging him. You should look upon it as the outward and visible sign that your customers are getting good service. And above all, you must take such precautions that your service may be relied upon by all who employ it. There is nothing that does so much to damage the business of a station as a reputation for unreliability.

In closing I wish to say that I am preaching no doctrine which I do not believe or which I do not try to follow. It is by electric light men and no others that the advice must be given to those who need it.

This is a final summary of the opinions I have presented:

(1) The electric lighting business should pay, as a reasonable profit, approximately the same rate as any manufacturing business which has similar risks. This profit should be paid after the expenses of operation, maintenance and depreciation shown by annual inventory have been provided for.

(2) Rates for electric supply should be so adjusted that each unit sold will pay its share of operating and standing charges, and in addition thereto a uniform proportion toward profit. No business should be done at a loss, and no business should pay more toward profit than its proper share.

(3) Every class of business that can be profitably done should be obtained. Business that improves the load factor should be taken if it can be obtained at any price greater than its share of operating and standing charges, because the improvement of the load factor reduces the amount of standing charges to be borne by the existing load.

(4) Business once obtained should be kept by careful study of and prompt attention to the requirements of each customer. It is not possible in the present stage of electric development for an American electricity supply company to limit its interest in the supply to its delivery on the customer's premises. It must do much work in order to secure that the customer uses the supply to the best advantage. It is not sufficient that a customer should be well served, he must also be well pleased.

(5) There is need of educational work to be done among electric light men, among municipal authorities, and municipal theorists, and among our own customers.

It is our interest that this educational work should be done, and as it does not appear to be the duty of any other person to do the work, we will have to do it ourselves.

On Cerium.

By M. BOUDOUARD, in *Comptes Rendus*.

In a note presented to the Académie (*Comptes Rendus*, Vol. CXXV., p. 950) MM. Wyrouboff and Verneuil criticised the results I obtained with cerium (*Comptes Rendus*, Vol. CXXV., p. 772).

1. While remarking on the difference in the origin of the oxides which were used by MM. Wyrouboff and Verneuil and myself, I will

show, first of all, that my analytical results did not present between themselves any greater differences than those of these gentlemen.

MM. Wyrouboff and Verneuil pointed out as an isolated fact that in the fractionations of the sulphate the mother-liquors gave figures sometimes higher and sometimes lower than those furnished by the crystalline deposits. In their own determination we observe absolutely the same facts either in one way or the other.

For example, MM. Wyrouboff and Verneuil found:

$$\text{I.} \left\{ \begin{matrix} \text{1st crystallization..} & 92.49 \\ \text{3d} \quad \text{“} \quad .. & 92.76 \end{matrix} \right\} d=0.27\,;\ e=\frac{0.27}{92.5}=0.0029$$

$$\text{II.} \left\{ \begin{matrix} \text{1st crystallization..} & 92.56 \\ \text{3d} \quad \text{“} \quad .. & 93.30 \end{matrix} \right\} d=0.74\,;\ e=\frac{0.74}{93}=0.0079$$

For my part, I obtained—

$$\text{I.} \left\{ \begin{matrix} \text{1st crystallization..} & 136.50 \\ \text{Mother-liquors} \ldots\ldots\ldots & \end{matrix} \right\} d=0.9\,;\quad e=\frac{0.9}{137}=0.0065$$

$$\text{II.} \left\{ \begin{matrix} \text{1st crystallization..} & 137.15 \\ \text{Mother-liquors.....} & 137.60 \end{matrix} \right\} d=0.45\,;\ e=\frac{0.45}{137}=0.0032$$

$$\text{III.} \left\{ \begin{matrix} \text{1st crystallization..} & 137.85 \\ \text{Mother liquors.....} & 139.90 \end{matrix} \right\} d=2.05\,;\ e=\frac{2.05}{139}=0.0144$$

Thus, MM. Wyrouboff and Verneuil qualify as *isolated* a fact given in my note, analagous results being also given in their memoir. I would remark that the error in both cases is equally great.

2. As to the difficultly acceptable observation that a cerium with an atomic weight of 137.85 has given two parts, of atomic weights of 140.7 and 138.5, that was a mistake on my part in writing the article only; there was nothing in common between the two series of determinations, and it should read: "Having made crystallizations of a sulphate prepared from a basic acetate," instead of "having made crystallizations of this same sulphate."

3. As to the action of peroxide of hydrogen on the acetate of cerium, as I always operated at a warm temperature I obtained a partial precipitation; that is, in fact, what I intended to do—it was not an error of observation. As to the purity of the oxide of cerium with which I worked, I believe it to be quite beyond criticism. MM. Wyrouboff and Verneuil insist that the criterion of plenty of oxide of cerium is that it should be of a white color; the oxide of cerium which I have obtained is white, and I took a great deal of trouble to free the cerium, not only from thorium, but from the other earths of the cerium and yttrium groups. I prepared the oxide of cerium by Debray's method, and it was the salts of this purified oxide that I fractionated.

The Sulphur Contents of Coke in their Relation to Blast Furnace and Cupola Practice.

[Translated from *Stahl und Eisen*, by MR. OSCAR SIMMERSBACH, for the *Am. Mfr.*]

Among the chemical components of coke, sulphur occupies the first and most important place as regards injurious action, and it is for this reason that the blast furnace man has to give it his full consideration. The sulphur contents in coke depend upon three things, namely, on the sulphur contents in the coal, its chemical composition, and the quenching of the hot coke after drawing.

The sulphur in coal originates undoubtedly in most cases, and to the largest extent, from iron pyrites which have entered into the coal after its deposition. The smallest part of the sulphur contents in coal occurs in the form of sulphates, of which but very small quantities have been found so far. Most of the sulphur is present in organic combination, and it is sometimes found in the form of iron pyrites in larger quantities. It is true that doubts have recently been expressed by Dr. Haussermann, of Stuttgart, as to the presence of sulphur in organic combination, but, for the furnace man, the presence of organic sulphur in coal will remain a fact.

The iron pyrites in the coal are decomposed in the coke oven, whereby, according to the equation—

$$2FeS_2 = Fe_2S_2 + S,$$

the fourth part of the sulphur contents would escape. Assuming a coke yield of 75 per cent. from coal containing 1.5 per cent. sulphur, the coke, according to the equation—

$$\frac{1.5 \times 0.75}{0.75} = 1.5 \text{ per cent. S},$$

would contain just as much sulphur as the coal. If the coke yield be lower than 75 per cent. the sulphur contents of the coke would become higher than that of the coal, for instance, with a 70 per cent. yield—

$$\frac{1.5 \times 0.75}{0.70} = 1.6 \text{ per cent. S}.$$

If less than the fourth part of the total sulphur should escape during coking, that is, should the desulphurization of the iron pyrites take place according to the equations—

$$7FeS_2 = Fe_7S_8 + 6S, \text{ or}$$
$$FeS_2 = FeS + S,$$

then there would be a lowering of the sulphur contents in the coke, and in the latter case the sulphur in the coke would amount to—

$$\frac{1.5 \times 0.5}{0.75} = 1 \text{ per cent.}$$

The higher the coke yield, the more sulphur is released by the decomposition of the iron pyrites, other conditions being equal.

The sulphates established in coal ash are mostly reduced during the coking process, chiefly $CaSO_4$ to CaS. Of the organically combined sulphur more or less is also released, which, like that released by the decomposition of the iron pyrites could escape altogether, if the relations to the chemical composition of the coal ash were not to be considered.

Coal ash contains oxide, carbonate and silicate of iron, and also combinations of lime and magnesia. The iron combinations are reduced in the coke oven, and at a comparatively low temperature, to metallic iron, which then, owing to its strong relation to sulphur, acts upon the released sulphur, and with it forms FeS. The more iron combinations in coal the more free sulphur is, of course, bound by combination. Lime and magnesia act in a similar manner. With the sulphurous carbon combinations originating from the free sulphur, both form sulphides; thus lime produces with sulpho-carbon sulphide of calcium, according to the equation—

$$2CaO + CS_2 = 2CaS + CO_2.$$

Even if considerable quantities of sulphur have become free in the coke oven, and therefore the possibility for the production of a coke poor in sulphur be given, the sulphur contents in the coke will still be large when the coal ash shows large quantities of ferric calcium and magnesia combinations. This also explains why a low sulphur coke is not always obtained from a low sulphur coal, and that it even may happen that the coke shows more sulphur than the coal, although in quenching the hot coke with water a further desulphurization is effected by the removal of a part of the sulphides as sulphureted hydrogen, according to

$$FeS + H_2O = FeO + H_2S.$$

This further desulphurization, however, is of less importance, as the structure of the coke, and especially that of dense coke, as well as the quick cooling of it, do not favor a marked reduction of the sulphur contents by steam.

Tests by C. von John, of the Imperial German Geological Office, have shown that the coals belonging to the older carbon formation lose less sulphur in the coke oven than coals of more recent formation, lignites losing most.

Sulphur in coke is injurious in the blast furnace because it goes down almost intact to the hearth where it is burned and gasified together with the coke. The sulphur in the ore, on the other hand, is already subjected in the higher zones to various influences, and therefore comes into less contact with the molten iron. From the sulphur in coke there is developed before the tuyeres sulphurous acid, which, during its ascent through the charge, is partly reduced. The released sulphur forms with iron sulphuret of iron. A part of this is decomposed at high temperature by the joint action of silicic acid and carbon, while other parts combine with manganese according to the equation—

$$MnO + 2FeS + 2C = Fe_2 + MnS + 2CO.$$

Still other parts are transformed together with lime and carbon into sulphide of calcium according to—

$$FeS + CaO + C = Fe + CaS + CO.$$

By the basic earths, too, the ascending sulphurous acid is absorbed after completed reduction at high temperature, and from sulphate of lime sulphide of lime is formed according to—

$$4CaO_4 + S = 3CaS + CaSO_4.$$

At a very high temperature there is a further decomposition of FeS_2 by carbon, whereby sulphocarbon is produced—

$$FeC + 2FeS = 3Fe + CS_2.$$

From the sulphureted iron there also separates a part of the sulphur which escapes as sulphocarbon. The latter produces again with lime sulphide of lime, according to the equation—

$$2CaO + CS_2 = 2CaS + CO_2.$$

Sulphide of lime is insoluble in the iron bath, and is absorbed by the slag, just as sulphate of lime and the sulphides of magnesia and manganese, while the sulphuret of iron with its high specific gravity passes into the iron. The molecules of the sulphur metals push themselves between the slag molecules during the formation of the latter and combine with them. But as the sulphur metals play no part in the process of assimilation to which the continuously collecting masses of silicate are subjected, they act in an obstructive manner only, and delay the process. As a consequence, the slagging action of sulphurous slag is much smaller than that of slag of equal composition, but containing no sulphur metals. The principal means in blast furnace practice for rendering the sulphur in coke harmless is a sufficient addition of lime. It is true that even with acid slag a part of the sulphur is removed, because silicon acts upon sulphuret of iron in the presence of carbon, but lime exercises a more favorable and stronger action. As the separation of sulphide of lime takes place only under formation of acid slag, lime has to be present in excess so that the desired basic properties of the slag can be maintained.

Magnesia acts generally less desulphurizing than lime. This is evident from the fact that sulphide of magnesia possesses much less heat than sulphide of lime. Yet, on the other hand, practical results have shown that with the use of dolomite in the blast furnace more sulphur was absorbed by the slag than with limestone when the ore was poor in alumina.

High manganese contents in the slag originating from the melting of highly manganiferous ores or fluxes promote likewise the absorption of the coke sulphur At equal temperatures, and charges being equally basic, the more sulphur is passed into the slag, the more manganese is present. Some authorities attribute even to manganese a stronger desulphurizing action than to lime.

It should never be ignored, however, that the temperature must always be sufficiently nigh, and that neither a large excess of lime nor manganese will be able to remove the injurious admixtures after they have once entered the iron.

During the remelt of the pig iron in the cupola, the sulphur in coke is subjected to similar influences as in the blast furnace process. But the reaction of sulphur and manganese is less important here than in the blast furnace, because there is generally but little manganese in the charge. By proper fluxing the total sulphur is passed into the slag, provided the temperature be high enough to convert sulphureted iron into sulphide of lime. Desulphurization is further promoted by basic lining. All this may well serve as an answer to the question, whether foundry coke may contain a maximum of 1¼, or 1½ per cent. of sulphur as English foundry men claim. At all events, foundry coke with 1 per cent. sulphur will do more damage in the absence of sufficient flux than coke with 1½ per cent. sulphur and an ample addition of flux.

The injurious action of sulphur in the production of pig iron manifests itself, as is well known, by the fact that sulphur reduces the total carbon and obstructs the formation of graphite, so that especially in the case of grey forge the injurious influence of the sulphur has to be removed. Sulphur also diminishes the fusibility and increases the hardness, but does not act to any considerable extent upon the properties of strength of the iron. In the cupola, iron with more than the usual sulphur contents easily becomes hard and white. It melts fast enough, but owing to its thick consistency it does not fill out the edges, points and sharp curves of the mold, and is, therefore, unfit for foundry purposes. The casting generally contains blow holes caused by escaping gases, such as sulphocarbon gas. By bringing sulphurous iron into contact with wet sand the development of sulpho hydrogen can be observed plainly.

High sulphur contents in coke constitute a pecuniary disadvantage in blast furnace practice, which in cupola work is felt less owing to the much smaller consumption of coke. Assuming that for the production of 1,000 kilos. of pig iron 1,600 kilos. of coke were required, as it is not unfrequently the case, there would be present if the coke contained 1 per cent. sulphur, 16 kilos. of sulphur which would be absorbed by 16 × 3.5 or 56 kilos. of limestone. A furnace producing 80 tons of foundry iron daily would therefore require 80 × 56 kilos. or 4.5 tons of limestone per day only on account of the sulphur in the coke. Besides, more flux requires more fuel, thus adding higher cost of fuel to higher cost of limestone. This loss will increase with the production of the furnace. From this it is easy to draw the conclusion that the less sulphur in coke the more profitable the working of the furnace.

Now, it is a matter of fact that nearly all coke shows an average of 1 per cent. sulphur, and that with the present methods of coking desulphurization is impossible. It is possible, however, that by charging pressed coal lower sulphur contents in coke can be obtained owing to the absolute as well as relative increase of the carbon contents, as with the pressed charge less air enters the oven than with loose coal, whereby the loss of carbon by burning is diminished, and consequently the percentage of sulphur is decreased.

Mica and Its Uses.

Invention remarks that the recent formation in London of the Mica Manufacturing Company, to acquire the mineral rights of mica properties in Canada, directs attention to the general uses of this interesting and useful mineral, or, rather, group of minerals. The name mica signifies to shine or glitter, and the word micas is applied to a large class or group of finely-foliated minerals, of a pearly luster, and transparent and translucent, tough and elastic. The distinguishing features are their brilliant luster or glitter, and the readiness with which they can be split or cut, to any desired thickness, into transparent plates. These laminæ can also be cut or divided with the aid of an ivory or steel knife, and so thinly that the sheets may be only 1-250,000th part of an inch in thickness. Another remarkable property of the micas, besides their distinct cleavage in one direction, is their great elasticity and toughness. Mica in the combination of elasticity and toughness is probably excelled by nothing natural or artificial.

The group of micas can be classified in two divisions: Muscovite or bi-axal, and magnesia or uni-axal mica. Muscovite or bi axal mica is in color amber, black, brown, white, silvery white, red, violet, gray and green (green and black being the usual tints), with pearly, metallic luster. It can only be fused on thin edges before the blow pipe, and has very tough and flexible leaves. It consists of silica, 46.3; alumina, 36.8; potash, 9.2; peroxide of iron, 4.5; fluoric acid, 0.7; and water, 1.8. Muscovite mica varies in hardness and in density. Magnesia or uni-axal mica (also called biotite) is in color brown, reddish, yellowish brown, olive green, gray, with pearly luster. It whitens in the blow-pipe flame, and melts on thin edges. Its hardness and density are identical with muscovite mica; and it is also so tough and elastic that it can be split or cut into sheets of tenuity. In magnesia mica, a certain proportion of magnesia replaces alumina, which is present to the extent of about 15 per cent. Magnesia mica is generally found in limestone. Other varieties of mica are the fuchite, a green mica, containing chrome; plumose mica, in which the scales are arranged in a feathery form; and rubelland, which is a name given to red mica. Granite is composed of crystals or crystalline masses of mica, quartz and feldspar. Mica is often confused with talc. But it differs from talc inasmuch as it affords thinner folia, and is elastic, and has not the same greasy feel. Then, again, talc will yield to pressure or indentation, while mica is nearly as hard as calcspar.

Mica is sometimes found in plates 2 or 3 feet in diameter, and perfectly transparent, in which state it is well adapted for use as a substitute for window glass. Its common use in this way in Siberia has procured for it the name of muscovy glass. It was formerly much used in the Russian navy, on account of its elasticity, rendering accidental explosion by percussion or concussion well nigh impossible. Mica ground in a mill increases vastly in bulk, and forms a loose mass of scales, not unlike bran. In this form it is largely used in a mica powder as an absorbent of nitro-glycerine, its peculiar elasticity rendering explosion impossible, while it does not interfere with the power or energy of the nitro-glycerine when exploded by a fulminate or other similar device. Mica, coarsely pulverized, is found to be an excellent roofing material, to which use it is also applied in the same manner as slate. It is also used in pulverized form for calico printing, and for decorating porcelain and glassware. When finally ground and reduced to powdered form, mica has a slippery and greasy character, and makes a good lubricant for railroad axles, bicycles, etc., and for all machinery requiring high speed. It keeps the bearings free from heat, even at the greatest speed, and, in the form of axle grease for railway cars, etc., it meets all requirements. Scrap or refuse mica, which has hitherto been regarded as valueless, is now used as a most efficient covering for steam boilers and pipes, on account of its non-conducting quality. Mica is also very largely used for electrical machinery, its insulating power being superior to that of any other substance. It will stand the highest test of heat, and is infusible, tough, and non-combustible. In this use the Canadian mica, more generally known as amber mica (being of amber color), is the most in demand in Canada and the United States.

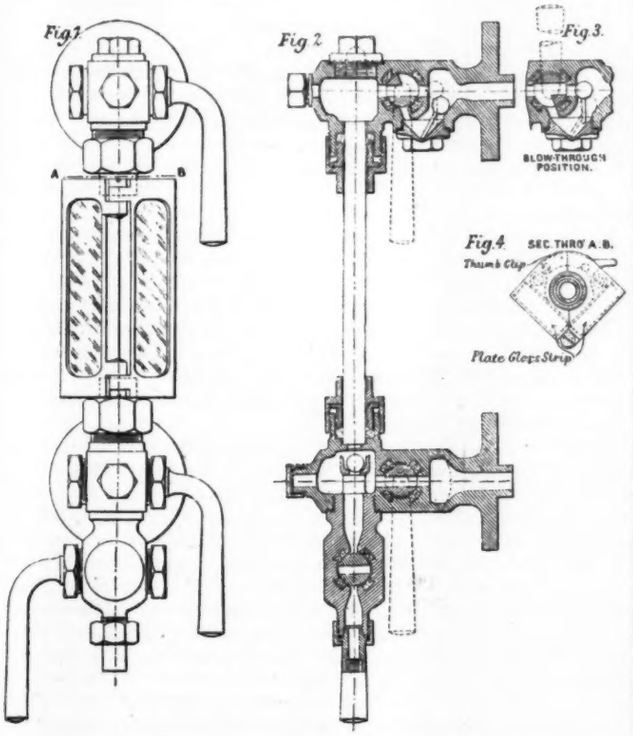
Mica is generally applied to marine compass dials, being highly superior to cardboard for the purpose. It is also used for the lettering of fancy signs; and, when very clear, affords a better protection to

photographs than enamel. It is artistically applied in the manufacture of lamp shades. With the aid of chromo-lithography, exquisite pictures are printed on sheets of mica, three or four of which are tastefully joined together, and form a really beautiful design. The whole group of micas affords a world of interest to the microscopist, as they frequently contain, between the layers, microscopic crystals of minerals, some of them forming specimens of wonderful beauty. Mica is also used for chimneys for lamps of all descriptions, and for asbestos and other stoves; also as a substitute for glass in spectacles in protecting the eyes in various mechanical operations; and, again, as a substitute for glass in silvered reflectors, in places where it would be exposed to heat, as in headlights, etc. Mixed with varnish, mica is used as a coating for wall papers, and in bronzing statuettes and other plastic articles. It is also applied, colored or metallized, to the decoration of churches, rooms, shops, frames and other ornamental and useful purposes. From its unalterable nature it preserves the gilding, silvering or coloring from deterioration, and from its diaphaneity, the articles so treated will not lose their original brilliancy. They are, moreover, further preserved, by the appliance of mica, in a state of perfect cleanliness, and from the action of all smoke and dust and the marks caused by insects, all such deterioration being easily removed by washing. The value of mica depends upon the size of the sheets and their transparency, the clear, ruby-tinted mica being the highest in value, and the cloudy the least valuable.

Such are the general uses and appliances of mica, though its usefulness is by no means exhaustively treated. Its properties have been found, of late years, to be so many and so varied that there appears to be at the present time a large and probably increasing demand for it, not only in Canada and the United States, but also in England and throughout Europe.

The Winn Gauge Glass Fittings.

The water gauge and gauge glass protectors, shown in the cuts, are constructed and being put on the market by Messrs. Chas. Winn & Co., of the St. Thomas Works, Granville street, Birmingham, England. It will be seen that the fittings are of a most substantial pattern, and that both the upper and lower cocks are provided with valves to stop the



rush of steam and water on the breakage of a glass. In the lower fitting the shell valve lies in a cup which has a hole pierced in its bottom The rush of water through and around the cup immediately carries the bell up and applies it to its seat, where it remains as long as the pressure is maintained. When the water is shut off, and the blow-off cock opened the ball falls back into the cup. The application of a ball valve to the upper fitting is not quite so simple. Here the cock, which like all the others, is asbestos packed, has three ways. In Fig. 2 it is shown in its normal position, and if the glass then breaks, the ball is immediately blown on to its seat, as shown in dotted line. After a new glass has been inserted the cock is turned into the position shown in Fig. 3, when the pressure is equalized on both sides of the ball, and it drops off.

However rapidly the valves may act in a gauge fitting, there must be some escape of hot water and steam. To prevent this from scalding the attendant, Messrs. Winn fit a protector, as shown in the illustrations. This comprises two gun-metal frames filled with thick strips of plate glass. These are hinged to one another, and are provided with clips which take on to the cylindrical projections shown in Figs. 2 and 4. These clips can be fixed and released by a touch of the finger, so that the glasses can be easily removed for cleaning or inspection. High pressure steam tries gauge glasses so severely that it is almost imperative to provide some kind of protection to guard the man from flying splinters and from the hot water.

The Text of a Bill to Regulate Gas Rates that is Worth Study.

On January 12th Mr. Green presented to the Assembly of New York a bill (No. 22), the title of which is "An Act to regulate the price of gas in the cities of the State, and providing for a Gas Board in each city of the State." Its provisions are so peculiar that perhaps a complete publication of the measure will be of value to the gas industry of the State, and in that view we here reproduce it in full:

Section 1. No corporation, association, company, copartnership or person doing business in any city of this State shall directly or indirectly through itself or another ask, demand, charge or receive for illuminating gas a sum to exceed $1 per 1,000 cubic feet, nor shall any such corporation, association, company, copartnership or person ask, demand, receive or charge any greater rate or price for gas furnished for lighting any private dwelling or business establishment than the lowest price or rate at which gas is furnished by such corporation, association, company, copartnership or person to any other private dwelling or business establishment in such city.

Sec. 2. Such gas shall have an illuminating power of not less than 24 sperm candles of six to the pound, and burning at the rate of 120 grains of spermaceti per hour, tested at a distance of not less than 1 mile from the place of manufacture, by a burner consuming 5 cubic feet of gas per hour, and shall also comply with the standard of purity now or hereafter established by law.

Sec. 3. A change hereafter effected in the territory or boundary of a city, either by annexation, consolidation or otherwise, shall be deemed to enlarge the territory within which the price of gas is regulated as herein provided, so that the price of illuminating gas in the territory or boundary annexed or consolidated shall be the same from the time of annexation or consolidation as exists in the territory or city to which such territory is annexed.

Sec. 4. The authorities or officials in each and every city of the State having power to contract for lighting the streets, avenues, piers, parks or other places, are hereby constituted in their respective cities a Board, to be known as the "Gas Board" of such city, which Board shall have all the power of the said officials, and in addition thereto shall have full power and authority, and it shall be their duty to investigate and supervise the methods, appliances and plant of any corporation, association, company, copartnership or person engaged in the supplying or distribution of illuminating gas in their respective cities, to regulate the distribution thereof, to ascertain whether the gas supplied is of a kind and quality and furnished in such manner as not to be injurious to the public, and to inspect, examine, ascertain and prove the accuracy of any and all gas meters or other appliances or apparatus used or intended to be used for measuring or ascertaining the quality and quantity of illuminating gas furnished by any such corporation, association, company, copartnership or person, to any city or person or persons.

Sec. 5. The Boards hereby constituted in their respective cities shall have authority to make all ordinances, rules and regulations necessary for the carrying out of the Act, and shall have power and authority in any investigation instituted by them to issue subpœnas, to summon witnesses, to compel the production of any books and papers, administer oaths to witnesses so subpœnaed, and false swearing before any such Board shall be deemed perjury and punishable as such, and to do each and everything necessary for the full and complete enforcement of this

Act; the said Boards, or any member thereof, or any person designated by said Boards, may enter and remain during business hours in the office, factories and other buildings, or upon the property or premises used by such corporations in the operation of their systems, and in the transaction of their business, and may examine the books and affairs of such corporations, and may cause to be subpœnaed witnesses to appear before them and testify as to any matter connected with any investigation or examination which such Boards by this Act are authorized to make. If a person duly subpœnaed fails to obey such subpœna, without reasonable cause, or shall without cause refuse to be examined, or to answer a legal or pertinent question, or to produce a book or paper which he is directed by subpœna to bring, or to subscribe his deposition if it has been correctly reduced to writing, the same shall be deemed a contempt and punishable as such as if it were a contempt of court, and the Board may take such proceedings as are authorized by the code of civil procedure upon the like failure or refusal of a witness subpœnaed to attend the trial of a civil action before a Court of record or a referee appointed by such Court, for the punishment of the person or persons for such contempt.

Sec. 6. The Boards hereby constituted are authorized to employ such assistants or clerks as may be necessary for carrying out the provisions of this Act, and the Boards or members thereof or any person or persons appointed by them may enter upon the premises of any person, corporation, association, copartnership or company, supplying illuminating gas, for the purpose of investigation or inspection so that the provisions of this Act may be effectually carried out; and the financial officers of each city chargeable with the making of appropriations shall pay all just requisitions made upon them by such Boards either by the issue of bonds which is hereby authorized or by the insertion of the amount required in the annual tax levy of such city, as the financial officers thereof shall deem proper.

Sec. 7. After the passage of this Act no person shall be appointed to, or hold office, or be a member of or hold any place or position under or in any Board created under or by virtue of this Act, in any city of the State, who holds any official or business relation to or with any illuminating gas corporation, copartnership, company, association, or person or persons dealing or in the business of supplying or manufacturing illuminating gas, or who owns stock or bonds therein, or who is in any way or manner peculiarly (*sic*) interested directly or indirectly in any firm, corporation, association, company, copartnership or person having business relations with any such corporation.

Sec. 8. Any city of the State, through and by the Board created by this Act with the consent of the Mayor and Common Council, or Board of Aldermen, Board of Supervisors, or other bodies having and performing like powers or functions, may establish, construct, or acquire by condemnation proceedings or other provisions of law, a plant for lighting by gas or electricity, its streets, public buildings and other places, and for supplying such light to its inhabitants, and may issue bonds therefor, and may conduct, manage and operate such works or plant by means of the Boards by this Act created, under the supervision and control of the Mayor and legislative body of the city.

Sec. 9. It shall be the duty of the Inspector of Gas Meters or his deputies, when required in writing by any person, to inspect, examine, prove and ascertain the accuracy of any and all gas meters, used for measuring or ascertaining the quantity of illuminating gas furnished by any gas light corporation, company, association or person, in this State, to or for the use of any person or persons and to certify under oath the result of such examination or inspection to the person requiring the same, and the Inspector or deputy making such examination or inspection shall make under oath and file a duplicate copy of said report in the office of the Inspector of Gas Meters in the place or city where the inspection is made and which report shall be a public record and open to the inspection of the public during reasonable hours.

Sec. 10. Any corporation, company, copartnership, association or person violating any of the provisions of this Act or the ordinances, rules or regulations enacted or adopted by the Boards created by this Act, shall be guilty of a misdemeanor and upon conviction thereof, shall be punished by a fine of not less than $500 for each offense, or by imprisonment in the county jail for a period not exceeding six months, or by both such fine and imprisonment and a conviction as herein provided shall operate as a forfeiture of all the rights, franchises or privileges pursuant to or under which any person, corporation, association, copartnership or company, is permitted to supply illuminating gas.

Sec. 11. All Acts and parts of acts inconsistent with the provisions of this Act, are hereby repealed.

Sec. 12. This Act shall take effect immediately.

The Arguments on the Appeal in the Matter of the Lease of the Philadelphia Gas Works.

In connection with the recent lease of the Philadelphia City Gas works for a term of 30 years by the United Gas Improvement Company it will be remembered that certain unhorsed politicians, disappointed competitors and "reform" element citizens in general tried to prevent it—and the transferring of the gas works from politics to a business basis—by injunction in the local Common Pleas Court, No. IV., and that after due argument, on Nov. 30 Judge Arnold, speaking for the full bench, handed down a decision entirely in favor of the United Gas Improvement Company, all as recounted in the number of the JOURNAL, dated December 16, 1897. It was thought that that practically ended the matter, as the chances of a reversal of the decision by the higher courts were so slight as to make it scarcely worth the while to litigate it farther. While an appeal was filed few felt that it would be pushed, and it probably would not have been had not the United Gas interests decided that it should be carried to the end, that the highest courts in the State should pass upon the questions involved, so that the Company for all time might not only know precisely "where it was at" in the matter, but also have legal justification for its position and all of its acts. As a result the whole question was reargued on the 24th ult., before the Supreme Court of Pennsylvania, and of the matter, our special correspondent "Traveller" writes as follows:

As two different bills were involved by the pooling of the issues of the several appellants, together with the city of Philadelphia and the United Gas Improvement Company as joint defendants, the galaxy of talent in the way of Philadelphia lawyers who were in evidence was great indeed, and numerous citizens and members of the local bar, as well as several ladies, appeared to enjoy prospective legal pyrotechnics. Sad to say, these were in the main disappointed, for the lawyers all around made their speeches brief, being apparently satisfied that it was largely a thrashing over of old straw, but necessary to get it on the record.

George Tucker Bispham for the "citizens" opened up. His argument was clever and interesting in showing what an evidence of technical objection could be raked up to the plain proposition that a city like an individual can do what it pleases with its own. He contended that the refusal of Court No. 4 to grant a preliminary injunction was an error, because the ordinance was an interference with certain executive functions which were expressly committed by the Act of June 1, 1885 (the Bullitt bill), to the Department of Public Works, and with which Councils were forbidden to interfere; because the ordinance assumed, in respect to the public lighting, to delegate a public legislative power, and with respect to the private lighting, to confer a monopoly on the grantee, and in both cases to bind the discretion of Councils for a long term of years; and, finally, because the ordinance impaired the obligation of the city's contract with certain holders of its bonds.

It was contended that the municipal authorities were not owners in their own right of the gas works, but were quasi trustees of that property for the citizens of Philadelphia, and as such, they have no power to divest themselves of the duties of the trust or turn the performance of such duties over to a grantee or lessee of the trust property. That the Act of 1879 expressly excludes from the power of sale "franchises, liberties and jurisdictions," and the Act of April 21, 1855, confines sales to such real estate, etc., as are "not held upon any trusts, and not held for any authorized public purposes."

Under the second heading, that the city has the power to light streets, but that it is not its duty to do so, it was contended that a modern city was in duty bound required to light its streets for the same reason that it was required to police the streets—*i. e.*, to protect the citizens from lawlessness and make the streets safe thoroughfares for passage; that the power to light streets was conferred upon the city by the statute of 1798, and has been exercised for more than a century; that generations have grown up under the assurance that the lighting of streets would be a portion of the protection afforded by the municipal authorities which they were entitled to enjoy, and it would therefore seem that the power was not to be regarded as a mere power, but is a power coupled with a trust; that the power to lease does not give the city the right to divest itself of municipal functions.

Considerable attention was also given to the fact that the gas lease contract gave the exclusive right to the United Gas Improvement Company to supply gas, etc., to the citizens, and it was argued that when a contract is made exclusive it amounts to a monopoly and is contrary to law.

In connection with the third contention, that the ordinance impairs

the obligation of the city's contract with certain holders of its bonds, it was shown that in the ordinance of December 26, 1863, by which a loan was created for the further extension of the gas works, it was provided that a certain percentage of the earnings of the gas works would be retained and set aside for the repayment of the loan. That the terms of this ordinance were equivalent to a specific pledge with the holders of the loan, and that in the case of the Western Saving Fund Society against the city it was held that similar provisions in an ordinance of June 17, 1841, were "as much a part of the contract as if they had been set forth at length in each certificate of loan."

That therefore the city, in leasing its works, has impaired the obligation of the contract with its bondholders because the Department of Public Works will be disabled from retaining the percentage mentioned in the ordinance out of the receipts for the sale of gas. That the gas lease ordinance has the effect of practically and legally interfering with, disturbing and jeopardizing the security of the bondholders. That it might be said the city is still to receive a portion of the proceeds from the sale of gas, viz.: All sums in excess of 90 cents per 1,000 feet until 1908 and also sums in excess of 85 cents per 1,000 feet until 1913, etc. That the reply to this contention was that the bondholder's security was, nevertheless, seriously disturbed and jeopardized inasmuch as the proceeds under the lease would only form a secondary lien and not a primary lien upon the earnings of the gas works. That the gas lease ordinance also provided that "it shall be competent for Councils to reduce these charges from time to time" to the stipulated charges to be paid the United Gas Improvement Company, and that the effect of this would be that there would thus be left no balances or receipts applicable to the payment of the loan.

All of this was very specious, and when it is remembered that the whole point at issue is simply whether the city of Philadelphia has a legal right to lease its gas works, it shows what a case can be built up if a sufficiently able lawyer is retained to do it. More learned counsel in the person of Alexander Simpson, Jr., followed—on behalf of other appellants—who dwelt chiefly on the theme that the lease was void because it was an attempt by the city to bargain away the subsequent rights of subsequent Councils of the city to pass ordinances touching matters which may be requisite for the well being of the citizens; because it was an attempt by the city to contract, not to exercise the police power; and because it is an attempt by the city to loan to the United Gas Improvement Company its property, effects and credit for the purpose of carrying on a business for joint benefit.

Having thus duly gone on record with all that they could conjure up in objection after many weeks of thought, the appellants subsided. Assistant City Solicitor, James Alcorn, then proceeded to prove by strong, elaborate and extensive arguments and citations that, despite what Mr. Bispham argued, he was all wrong and that the city had every right to lease its own gas works or any other property it owned if it wanted to.

He contended that the gas lease ordinance and the contract of lease authorized thereby were not invalid under the Bullitt law because Article XVI. of that act provided that "Councils shall, by general ordinances, provide for the proper and efficient conduct of the affairs of the city by the Mayor and the several departments," etc. That the Act of 1789 expressly empowers the municipal authorities to grant, "bargain, sell, mortgage, pledge, charge and encumber or demise and dispose of at their will and pleasure the property of the corporation."

That no statutes of the Commonwealth forbid the execution of the lease in question or direct that this or other cities shall, in their municipal character, conduct the business of making and supplying gas either for private or public use. As a matter of policy it was freely opened to municipal communities, both in this State and elsewhere, to choose whether they should employ their own or other agencies for the supply of water and gas. That the evident intention of the Legislature not to restrict such choice, but to leave the several cities of the State at liberty to decide for themselves, would appear from the various acts dealing with municipal powers and with the rights and obligations of gas and water companies.

The concluding portion of the argument referred to the alleged impairment of the contract with the holders of the gas loans, alleged to have been affected by the gas lease ordinance. Counsel for the city contended that the gas lease ordinance did not conflict with or impair the rights acquired by the holders of the loans; that the agreement with the loan holders did not constitute any lien upon the gas works or their receipts.

All of this contention seems but common sense, sound doctrine and convincing. To make it even stronger, however, it was fortified at its conclusion by the arguments of John C. Johnson and Chas. E. Morgan, Jr., on behalf of the United Gas Improvement Company, whose argument in brief was that if Councils have the power to make the lease under existing laws, their discretion in exercising this power could not be the subject of review, it being well settled that where a discretion is vested and is being exercised lawfully and honestly by the individual or the body upon whom it is conferred by the Legislature, it cannot be controlled, limited or reversed by a court. That prior to the passage of the Bullitt bill the power of the city to lease its gas works had not been questioned, and the Bullitt bill did not, either by express terms or by implication, take from the city or curtail the power to lease the gas works theretofore vested in it.

In connection with the allegation that the gas lease would impair the loan, it was contended that an examination of the form of loan certificates showed that they were merely contracts to pay money made by the city and there was no reference whatever to any security of any kind.

This ended the proceedings, whereupon the honorable court announced, as usual, that it would reserve its decision, and all hands went home.

Nobody doubts but that the counsel for the city of Philadelphia and the United Gas Improvement Company are sound in their position, and that the decision of the Pennsylvania Supreme Court when handed down will be but an affirmation of the judgment of the court below. At any rate, the United Gas Improvement Company doesn't seem to be worrying over the outcome. It is expending much money and shaping work for enormous additions to the old city plant, both in works and mains, as soon as spring weather permits. It has already put into effect office conveniences and courtesies to the public, unknown under the *regime* of past political directors, and has so increased the candle power and service, in at least one portion of the city, that plain, ordinary, everyday, disinterested citizens have volunteered comments of approval, after visibly noticing the better service.

The United Gas Improvement Company is running the business now, and on a business basis. The Supreme Court will affirm its right to do so, and the public—mark this prediction—will have no quarrel coming with the results.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

MR. LOUIS F. GRAF has been appointed Secretary of the Belleville (Ills.) Gas Light and Coke Company, vice Mr. John Penn, resigned.

AT the formal reorganization of the Lansing (Mich.) Gas Light Company, the Hon. O. M. Barnes, who has been President of the Company since 1873, tendered his resignation, as did Mr. E. F. Cooley, who has served the Company as Treasurer for a like term. The resignations were accepted, and Mr. B. G. Dawes was elected to the vacant offices. Mr. Leonard E. Walker was re elected Secretary.

MR. JOHN A. HUDSON, for ten years Mayor of Bordentown, N. J., and Superintendent of the Bordentown Gas Light Company, for well over a quarter of a century, died at his home in Bordentown on the morning of Jan. 22. Deceased, who was in his 51st year, was one of the most popular residents of Burlington County, N. J., and besides the places named above as being held by him, for over a score of years he served (with attention to the responsibilities of the post) on the Board of Trustees of the Schools of Bordentown.

AT the annual meeting of the Springfield (Mass.) Gas Light Company the Directors chosen were: W. H. Haile, Marvin Chapin, James A. Rumrill, Henry S. Lee, E. S. Brewer, Homer L. Bosworth, D. Chauncey Brewer, C. L. Goodhue and W. F. Callender; Treasurer, Ira B. Allen; Secretary, E. G. Brewer. The Company enjoyed a fairly prosperous year. We understand that the Company proposes this year to extend its main system to the town of Longmeadow.

IT is reported that the accounts of Mr. R. Theodore Cook, Secretary of the Alexandria (Va.) City Gas Works, show a deficit of $3,000.

THE Los Angeles (Cal.) Lighting Company is to be congratulated on a very good increase in its gas trade for the last fiscal year. From the reports presented at the annual meeting it was shown that the Company had put out 313 additional meters, and that something over 7 miles of mains had been added to the distributing system. The officers elected were: Directors, Wm. M. Van Dyke, S. W. Garretson, William A. Cheney, W. B. Cline and R. M. Adams; President and General Manager, W. B. Cline; Vice-President, William M. Van Dyke; Secretary and Treasurer, R. M. Adams.

THE proprietors of the Louisville (Ky.) Gas Company propose to contest the right of the Kentucky Heating Company to supply artificial gas for lighting and heating purposes in Louisville. The Louisville Company's charter seemingly gives it the exclusive right to supply artificial gas, although the charter does contain this section: "Provided that nothing in the charter shall be so construed as to prevent other parties from selling natural gas for heating and lighting." The Kentucky Heating Company has for some years been distributing natural gas in Louisville, but in the winter season the supply from the wells has not been sufficient to meet the demands of its customers, so the service was supplemented by an output of water gas. It is this mixed supply which the Louisville Company will try to prevent.

GEN. RUSSELL M. THAYER, Am.Soc.C.E., who has been Chief Engineer and Superintendent of Fairmount Park, Phila., Pa., since 1875, resigned that post to accept a responsible position in connection with United Gas Improvement Company's operation of the Philadelphia gas works. Gen. Thayer is a graduate of West Point, and at one time was on the engineering staff of the Penna. Railroad.

"OBSERVER" forwards the following paragraphs: "The Brockton (Mass.) Gas Light Company is now completely installed in its new plant, which is a model one in all respects. It is of the coal gas type, and was built by Messrs. Bartlett, Hayward & Co., of Baltimore. It has a present capacity of 250,000 cubic feet per day, with opportunity for extension to 750,000 cubic feet, without alteration of the existing apparatus or connections. Coal is taken from an elevated siding into a shed having a capacity of 1,500 tons, which directly adjoins the retort house. The retort house is a neat brick structure with iron roof, and and is 90 feet by 40 feet in dimension. It contains six benches of 6's, built by Mr. James Gardner, Jr., of Pittsburgh, Pa., with recuperative furnaces of his design, and a battery of two 40-horse power boilers. The charging floor is of heavy iron plates, supported on I-beams, and covering a brick paved cellar, which extends the entire width of the building in front of the benches, and is well ventilated by areas. The benches are equipped with self-sealing lids, ample standpipes, and a wrought iron hydraulic main of the most modern design. Passing by the boilers, which occupy, with their pumps, etc., one end of the retort house, a swinging door opens into the exhauster room, which is about 16 by 40. The gas passes, first, through a hot scrubber in one end of the room, and then through a No. 5 Root exhauster. These pieces of apparatus, as well as all others about the works, are arranged with bye-pass valves and blank connections for duplicate apparatus. Passing across the yard, entrance is had to a building, 85 feet by 40 feet, which contains the office and meter room combined, the scrubber and condenser room, and the purifying room. This is a brick building of the same general design as the retort house, and has a slate roof. It is practically two stories in height, and each room is separated from the others by brick partition walls, having no openings in them. Communication is had with them by a balcony extending along one side of the building with doors to each room, and corresponding doors on the ground for entrance to the basement. The condenser room is fitted with a multitubular water condenser and a standard scrubber. The purifiers are 12 feet by 12 feet, and are fitted with the Berlin valve, which allows the operation of any of them. In the roof of the purifying room is supported a large tank supplied with water from a driven well, furnishing water for all the uses of the works. Leading from the purifying room, and separated by a fire door, is the oxide and lime room. This is of wood, with gravel roof, and has a cement floor, and brick sides to a height of 3 feet, thus protecting the wood against possible contact with heated sponge. At one end of this building is the office, which contains the meter through which the gas passes on its way to the holders, and a Connelly governor, through which the gas passes out to the street; besides which there is ample room for the necessary office business of the works. The first floor or basement is well lighted and ventilated, affording the best possible opportunity to get at all connections and tar drains, and also ample room for storage. The tar and liquor are all carried to one separating tank of large capacity. At the extremity of the lot is the holder, which is of the double lift, steel tank type, and is of 208,000 cubic feet capacity. It has 16-inch connections, and is so situated as to allow the erection adjoining it of one having 1,000,000 cubic feet additional capacity, if desired. In general, it may be said that the works are neat and substantial in appearance, are well filled with modern apparatus, so put up as to be easily got at both internally and externally, and so arranged as to be operated, with the minimum amount of labor, with ease and economy.—The Davis & Farnum Manufacturing Company, having moved into its new foundry, is now turning out work from it. It is thoroughly equipped with the most modern apparatus, particularly in the line of steam handling machinery. With the additional facilities granted by the new plant, the firm is in position to turn out at short notice large quantities of work."

THE Logan Iron Works, of Brooklyn, N. Y., has entered into a contract for the construction of a gas plant at the works of the American Coffee Company, North Third street, Brooklyn, N. Y.

AT the annual meeting of the Summit (N. J.) Gas Light Company the following officers were chosen: Directors, M. M. Dodd, W. D. Mitchell, Eugene Vanderpool, S. H. Plum, C.W. Isbell, A. F.Wehner, Jr., and R. K. Wehner; President, S. H. Plum; Treasurer, A. F.Wehner; Secretary, R. K. Wehner, Jr.

The Isbell-Porter Company, of this city, has agreed to construct for the New York Mutual Gas Light Company four purifying boxes, to have a dimension of 22 feet by 36 feet by 3½ feet deep. The boxes are to have 24-inch connections.

MR. WALTER G. AFRICA, Manager and Superintendent of the Peoples Gas Light Company, of Manchester, N. H., has been elected President of the Manchester Board of Trade.

ADVICES from Alton, Ills., are to the effect that the proprietors of the Alton Railway and Illuminating Company intend to make important improvements on their gas plant (it is located on Belle street) this spring.

THE Directors of the Westfield (Mass.) Gas Company have decided to put the gas rate at $1.60 per 1,000 cubic feet. Hitherto the rate was $2 per 1,000 gross, with 20 cents off per 1,000 for prompt payment.

AT the annual meeting of the Coldwater (Mich.) Gas Light and Fuel Company the officers chosen were: Directors, G. C. Turner, L. M. Wing, J. G. Parkhurst, W. A. Coombs and H. C. Loveridge; President, Wm. A. Coombs; Vice-President, H. C. Loveridge; Treasurer, F. W. Moore; Secretary, A. L. Zwisler.

MR. WILLIAM P. TAYLOR, Secretary of the Wilmington (Del.) Coal Gas Company, informs us that the dividend for the last 6 months ($3 per share) is payable on demand.

AT the annual meeting of the Yonkers (N.Y.) Gas Light Company, the following officers were elected: Directors, W. W. Scrugham, R. P. Getty, S. D. Babcock, Jas. Slade, Harold Brown, Alex. Smith Cochran, Alfred Jones, John K. Bangs and H. A. Robinson; President, W. W. Scrugham; Secretary, J. D. McIntyre.

IT is likely that this news is accurate—it originally appeared in Seisinger's Philadelphia *News Bureau* reports of recent date: "President Maloney, of the Pennsylvania Heat, Light and Power Company, is to be President of the new consolidated Electric Light Company. No other name than Mr. Maloney's has been considered for the Presidency, we are told. There will go into the Board with him, we are informed, most if not all of the present members of the Pennsylvania Heat Company Board, of which five members—Messrs. Dolan, Gibbs, Philler, Graham and William L. Elkins—are also in the United Gas Improvement Company Board. Thus the Pennsylvania Heat Company will be largely represented in the management of the new Company. It is probable that President Latta, of the Powelton Company, who took a prominent part in bringing about the deal, and some of his associates, will have place in the new directory, and that it will be larger than the present Board of the Pennsylvania Heat, Light and Power Company. We are told by a Director of one of the Companies that there is to be no leasing of any of the Companies to the new operating Company. It will simply hold a controlling interest in each of the Companies in the consolidation."

CAPTAIN ANDREW JENSEN is the reported sponsor for the proposed gas plant at Great Falls, Mont. The ordinance offered, which was drawn by Attorney George H. Stanton, provides for the laying of mains and pipes through streets, but the time for the commencement of construction and manufacture of gas was left blank, to be filled in at a later date. Under its terms Captain Jensen and his associates or grantees are to extend the pipes as rapidly as possible, and are to furnish a

(*Continued on page* 215.)

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
EDITORS.

CHAS. E. SANDERSON,
MANAGER.

PUBLISHED ON EACH MONDAY OF THE YEAR AT
No. 32 Pine Street, New York.

The JOURNAL is the official organ of the
NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.
AMERICAN GAS LIGHT ASSOCIATION.
WESTERN GAS ASSOCIATION.
OHIO GAS LIGHT ASSOCIATION.
PACIFIC COAST GAS ASSOCIATION.
TEXAS GAS AND ELECTRIC LIGHT ASSOCIATION.

TERMS:

SUBSCRIPTION—Three Dollars per annum, in advance
Single copies, 10 Cents.

AGENTS:

New York—American News Co., 39 and 41 Chambers St.
Germany—Lemcke & Buechner, of New York.
England—Aug. Siegle, 30 Lime Street, London.

MONDAY, FEBRUARY 7, 1898.

(*Continued from page* 214.)

gas of 20-candle power, for $3.50 for 1,000 feet; street lamps and posts are to be placed where designated by the City Engineer, without cost, and light is to be furnished to the city for $2.50 per month for each lamp. Provision is also made for the filing of an acceptance with the City Clerk within a reasonable time after the passage of the ordinance and for the restoration of the streets to their former condition after the mains and pipes are laid, the city to be saved harmless from any claims for damages on account of excavations or accidents on account of them. The franchise is to run for 20 years, but is not an exclusive one, and is to take effect from and after its passage.

THE shareholders of the Evansille (Ind.) Gas and Electric Light Company have named Mr. Sebastian Henrich to the vacancy on the Board caused by the death of Jacob Weintz.

THE papers announcing the incorporation of the Peru and La Salle (Ills.) Gas Light and Power Company have been filed. This probably means the complete reorganization of the artificial lighting properties of the places named.

THE proprietors of the Warren County Gas Company of Phillipsburg (N. J.) have elected the following officers: Directors, Samuel Thomas, W. M. Davis, David Mixsell, D. J. Seifert, M. Kenny, Andrew Smith and John Franks; President, John Franks; Secretary, David Mixsell; Superintendent, Valentine Weaver. A semi-annual dividend of 3 per cent. was declared.

THE executive management named by the proprietors of the Greenville (Ohio) Gas Company is as follows: Directors, J. T. Martz, F. T. Conkling, F. M. Eidson, Wm. Thompson, J. C. Elliott, R. S. Frizell, J. H. Schwable and D. P. Irwin; President and Treasurer, J. T. Martz; Vice-President, F. T. Conkling; Secretary and Superintendent, J. C. Turpen.

THE Potter Gas Company, of Genesee township, Pa., has been organized by Messrs. J. Newton Peck, John F. Stone, S. E. Larrabee, W. I. Lewis and L. C. Lewis.

Peace in the Western Coal Trade.

Iron Age says that, according to general opinion, one of the most important industrial contests in the history of this country came to a peaceful conclusion in Chicago last month after a ten days' struggle. The bituminous coal operators and miners of Illinois, Indiana, Ohio and the Pittsburgh thin vein district of Western Pennsylvania, with a portion of West Virginia, met to agree upon a scale of wages for the year ending April 1, 1899, in order to avoid friction in this important industry. It is stated that no less than 200,000 miners are affected by the scale which was adopted. This is not only an enormous number of workmen, but dependent upon their labors is a much greater army employed in all sorts of occupations in the Central West which cannot be prosecuted without a regular supply of coal. The questions to be settled between the operators of the different sections and the coal miners were so complicated that from time to time the difficulties seemed insurmountable, and hope of harmony would almost be extinguished. But both sides were deeply anxious to have a fair settlement made and renewed efforts were put forth as old propositions were set aside, until finally common ground was struck amid mutual rejoicing.

The leading features of the agreement are a uniform working day and a straight increase of 10 cents per ton in miners' wages. The uniform day is to consist of eight hours, with eight hours' pay, and for six days per week, with uniform wages for day labor in all districts. The 8 hour day will enable the operators to employ more miners and secure an increased output of coal, which will be needed this year with the great improvement in general business. The price of coal has been so exceedingly low that no consumer will begrudge the enhanced price he may be called upon to pay in consequence of the advance of 10 cents per ton in miners' wages, while this advance will make the miners more liberal consumers of all sorts of products, and thus assist in swelling the tide of general prosperity.

It is indeed gratifying that in this great industry the employers and their employees have been able to get together and harmonize their differences so that all danger of trouble in this direction has been banished for at least 14 months. The strike of last year, although costly to both operators and miners, may be credited with some good results, as it undoubtedly was a potent influence in impelling the diverse interests to continue their conferences persistently until a basis of settlement was reached. Everybody being desirous of avoiding the possibility of another serious strike in the next year or two, the essential groundwork of an agreement was ready made.

The Market for Gas Securities.

The market for city gas shares remained steady to strong since time of last writing, the good undertone having been sounded to the odd accompaniment of small transactions. The peculiar doings in connection with proposed gas legislation at Albany have attracted some attention, but it looks that Wall street has made up its mind in that instance. The determination, speaking in a general way, is that the graded rate, will run its course, and then other legislative adjustments may be in order. Consolidated opened to-day (Friday) at 191 to 192¼, with sales at the latter figure towards noon. The general belief amongst well informed operators in the market is that all classes of local gas shares afford, at current prices, fair opportunity for profit on the long side. Standard common is a trifle better than was the case a week ago, while the preferred is weaker. Equitable is somewhat stronger, and Mutual is very much firmer.

East River shows no particular change. Among the current rumors is one to the effect that the proposed dock line extension and improvement from Gansevoort Market, on the south, to West 23d street, on the north, which proposition involves to the Consolidated Company the loss of its Manhattan station, west, may be begun at the north line rather than the south. In this event the Manhattan (west) station could be preserved to the Company for a year or so, thus postponing the reconstruction of the Manhattan (east) station. From this the "wise" predict that actual consolidation of the city gas interests is not imminent; which goes to show that the "wise" are easily affected in their judgment?

Out of town shares, save Lacledes, are generally higher. The decline in Lacledes amounts to about 3 points. Peoples, of Chicago, maintains its advance, Baltimore Consolidated recovered pretty well from its drop of a week ago, and Brooklyn Union holds close up to the high figures recently made in it. Bay State, of course, is pulseless, although a feeble flicker comes to it once in a while through the reports that other suits for the appointments of receivers for its properties have been instituted. Western, of Milwaukee, is quietly going on to par, and Detroit gas also shows signs of strength.

Gas Stocks.

Quotations by Cochran & Close, Brokers and Dealers in Gas Stocks.

35 WALL ST., NEW YORK CITY.

FEBRUARY 7.

☞ All communications will receive particular attention

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$36,230,000	100	191	192⅛
Central	500,000	50		..
" Scrip	230,000	..	100	.
Equitable	4,000,000	100	227	235
Bonds, 6's	1,000,000	1,000	105	.
" 1st Con. 5's	2,300,000	1,000	114	.
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	312	325
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	.	..	.
Northern	150,000	50	..	
" Bonds	150,000	1,000	..	
New York and East River	5,000,000	100	81½	..
Preferred	2,000,000	100	112	115
Bonds 1st 5's	3,500,000	1,000	112	113
" 1st Con. 5's	1,500,000	..	105	106⅛
Richmond Co., S. I.	348,650	50	70	..
" Bonds	100,000	1,000	..	
Standard	5,000,000	100	146	148
Preferred	5,000,000	100	160	165
Bonds, 1st Mortgage, 5's	1,500,000	1,000	114	115
Yonkers	299,650	50	130	
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	123¼	123⅝
" " Bonds (5's)	15 000,000	1,000	114⅝	114¾
Bay State	50,000,000	50	3¾	4
" Income Bonds	2,000,000	1,000	..	75
Boston United Gas Co.—				
1s Series S. F. Trust	7,000,000	1,000	96¾	97
2d " " " "	3,000,000	1,000	..	88
Buffalo Mutual	750,000	100	125	..
" Bonds	200,000	1,000	95	100
Central, San Francisco	2,000,000	..	95	..
Chicago Gas Company	25,000,000	100	97¾	97⅝
Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Columbus	1,000,000	.	89	90
1st Mortgage	1,085,000	..	..	90
Consumers, Jersey City	2,000,000	100	77	..
" Bonds	600,000	1,000	102	105
Cincinnati G. & C. Co.	8,500,000	100	206⅛	207

Consumers, Toronto	1,600,000	50	184½	187
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000		
Consolidated, Baltimore	11,000,000	100	55⅛	55¼
Mortgage, 6's	3,600,000	..	107	107½
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490,000	..	..	..
Consolidated G. & E. Co.'s, Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit	4,000,000		55	57
" Con. Bonds	4,312,000	..	97	97½
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	81	93
" Bonds	2,000,000	..	93	95
Hartford	750,000	25	..	145
Indianapolis	2,000,000	..	118	125
" Bonds, 6's	2 650,000	..	107	109
Jersey City	750,000	20	180	..
Lafayette Gas Co., Ind.	1,000,000	100	86	88
Bonds	1,000,000	1,000	92	94
Louisville	2,570,000	50	..	..
Laclede, St. Louis	7,500,000	100	43¾	44
Preferred	2,500,000	100	90	92
Bonds	9,084,400	1,000	105½	105
Montreal, Canada	3,000,000	100	200	.
Newark, N. J., Gas Co.	1,000,000	..	200	220
Bonds, 6's	4,000,000	..	128	130x
New Haven	1,000,000	25	228	..
Oakland, Cal.	2,000,000	..	53½	54
" Bonds	750,000	..	..	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	97¾	98
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,00	1,000	.	108
2d "	2,500,000	1,000	104	105
Peoples, Jersey City	500,000	50	..	175
Rochester Gas & Elec. Co.	2,150,000	50	..	..
Preferred	2,150,000	50	88	..
Consolidated 5's	3,000,000	..	87½	90
San Francisco, Cal.	10,000,000	100	94	94½
St. Paul Gas Light Co.	1,500,000	100	49	51
1st Mortgage 6's	650,000	..	84	87
Extension, 6's	600,000	..	..	..
General Mortgage, 5's	2,400,000	.	88	90
Syracuse, N. Y.	2,500,000	25	21½	23
Bonds	1,000 000		94	97
Washington, D. C	2,000,000	20	250	
Western, Milwaukee	4,000,000	100	85	86
Bonds, 5's	3,556,000	.	102	103
Wilmington, Del.	550,000	50	200	

Advertisers' Index.

GAS ENGINEERS.

Page

Wm. Henry White, New York City ... 235
Fred. Bredel, Milwaukee, Wis. ... 220
Geo. R. Rowland, New York City ... 235
The Western Gas Construction Co., Fort Wayne, Ind. ... 222
Humphreys & Glasgow, New York City ... 226
American Gas Co., Phila., Pa. ... 220
David Leavitt Hough, New York City ... 237
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 235

PROCESSES.

Bartlett, Hayward & Co., Baltimore, Md. ... 233
United Gas Improvement Co., Phila., Pa. ... 225
Burdett Loomis, Hartford, Conn. ... 234
National Gas and Water Co., Chicago, Ills. ... 227
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 235
The Western Gas Construction Co., Fort Wayne, Ind. ... 222
Humphreys & Glasgow, New York City ... 226

GAS WORKS APPARATUS AND CONSTRUCTION.

James R. Floyd's Sons, New York City ... 236
Continental Iron Works, Brooklyn, N. Y. ... 234
Deily & Fowler, Phila., Pa. ... 236
Kerr Murray Mfg. Co., Fort Wayne, Ind ... 232
Stacey Mfg. Co., Cincinnati, Ohio ... 235
Bartlett, Hayward & Co., Baltimore, Md. ... 233
Davis and Farnum Mfg. Co., Waltham, Mass. ... 232
R. D. Wood & Co., Phila., Pa. ... 234
Isbell-Porter Company, New York City ... 234
Fred. Bredel, Milwaukee, Wis. ... 220
United Gas Improvement Co., Phila., Pa. ... 225
Berlin Iron Bridge Co., East Berlin, Conn. ... 217
National Gas and Water Co., Chicago, Ills. ... 228
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 235
The Western Gas Construction Co., Fort Wayne, Ind. ... 222
Humphreys & Glasgow, New York City ... 226
Gas Engineering Co., Pittsburgh, Pa. ... 232
American Gas Co., Phila., Pa. ... 220
Logan Iron Works, Brooklyn, N. Y. ... 236
Riter-Conley Co., Pittsburgh, Pa. ... 219

SCRUBBERS AND CONDENSERS.

G. Shepard Page's Sons, New York City ... 235
R. D. Wood & Co., Phila., Pa. ... 234
James R. Floyd's Sons, New York City ... 236
Continental Iron Works, Brooklyn, N. Y. ... 234
Gas Engineering Co., Pittsburgh, Pa. ... 232
Logan Iron Works, Brooklyn, N. Y. ... 236
Riter-Conley Co., Pittsburgh, Pa. ... 219
Kirkham, Hulett & Chandler, London, Eng. ... 219

REGENERATIVE FURNACES.

Bartlett, Hayward & Co., Baltimore, Md. ... 233
Fred. Bredel, Milwaukee, Wis. ... 220
J. H. Gautier & Co., Jersey City, N. J. ... 240
Parker-Russell Mining and Mfg. Co., St. Louis, Mo. ... 230
Adam Weber New York City ... 230

TAR AND CARBONIC ACID EXTRACTOR.

G. Shepard Page's Sons, New York City ... 235
R. D. Wood & Co., Phila., Pa. ... 234

AMMONIA CONCENTRATORS.

Michigan Ammonia Works, Detroit, Mich. ... 217
G. Shepard Page's Sons, New York City ... 235
Gas Engineering Co., Pittsburgh, Pa. ... 232

GAS METERS.

John J. Griffin & Co., Phila., Pa. ... 240
American Meter Co., New York and Philadelphia ... 239
Helme & McIlhenny, Phila., Pa. ... 239
D. McDonald & Co., Albany, N.Y. ... 237
Nathaniel Tufts, Boston, Mass. ... 238
Maryland Meter and Mfg. Co., Baltimore, Md. ... 238
Metric Metal Co., Erie, Pa. ... 238
Keystone Meter Co., Royersford, Pa. ... 238
Detroit Meter Company, Detroit, Mich. ... 239

PREPAYMENT METERS.

American Meter Co., New York and Philadelphia ... 239
John J. Griffin & Co., Phila., Pa. ... 240
D. McDonald & Co., Albany, N. Y. ... 237
Helme & McIlhenny, Phila., Pa. ... 239

GAS AND WATER PIPES.

Ohio Pipe Co., Columbus, Ohio ... 237
M. J. Drummond, New York City ... 237
R. D. Wood & Co., Phila., Pa. ... 234
Warren Foundry and Machine Co., New York City ... 237
Donaldson Iron Co., Emaus, Pa. ... 237

PIPE CUTTERS.

The Anderson Pipe Cutter Co., Marlboro, Mass. ... 218

STEAM BLOWER FOR BURNING BREEZE.

H. E. Parson, Brooklyn, N. Y. ... 227

GAS COALS.

Penn Gas Coal Co., Phila., Pa. ... 229
Perkins & Co., New York City ... 228
Despard Gas Coal Co., Baltimore, Md. ... 229
Westmoreland Coal Co., Phila., Pa. ... 229
Berwind-White Coal Mining Co., New York and Phila. ... 228
W. D. Althouse & Co., Phila., Pa. ... 229

CANNEL COALS.

Perkins & Co., New York City ... 228
W. D. Althouse & Co., Phila., Pa. ... 229

GAS ENRICHERS.

Standard Oil Co., New York City ... 229
The Sun Oil Co. Pittsburgh, Pa. ... 229

COKE CRUSHER.

C. M. Keller, Columbus, Ind. ... 229

CONVEYING MACHINERY.

C. W. Hunt Company, N. Y. City ... 217

GAS GAUGES.

The Bristol Co., Waterbury, Conn. ... 219

GAS GOVERNORS.

Connelly Iron Sponge and Governor Co., New York City 227
Isbell-Porter Co., New York City ... 234
The Wilder Mfg. Co., Phila., Pa. ... 219
R. D. Wood & Co., Phila., Pa. ... 234
Wm. M. Crane & Co., New York City ... 218

SELF-SEALING MOUTHPIECE DOORS.

Isbell-Porter Co., New York City ... 234
Continental Iron Works, Brooklyn, N.Y. ... 234
G. Shepard Page's Sons, New York City ... 235
Logan Iron Works, Brooklyn, N. Y. ... 236
R. D. Wood & Co., Phila., Pa. ... 234

CEMENTS.

C. L. Gerould & Co., Mount Vernon, N.Y. ... 230

RETORTS AND FIREBRICKS.

J. H. Gautier & Co., Jersey City, N. J. ... 240
B. Kreischer & Sons, New York City ... 230
Adam Weber, New York City ... 230
Laclede Firebrick Mfg. Co., St. Louis, Mo. ... 230
Cyrus Borgner, Phila., Pa. ... 230
James Gardner, Jr., Pittsburgh, Pa. ... 230
Henry Maurer & Son, New York City ... 230
Baltimore Retort and Firebrick Co., Baltimore, Md. ... 230
Parker-Russell Mining and Mfg. Co., St. Louis, Mo. ... 230
Brooklyn Firebrick Works, Brooklyn, N. Y. ... 230
F. Behrend, New York City ... 218

INCANDESCENT GAS LAMPS.

Welsbach Commercial Co., Phila., Pa. ... 224

MICA GOODS.

The Mica Mfg. Co., New York City ... 217

BURNERS.

C. A. Gefrorer, Phila., Pa. ... 234
Wm. M. Crane & Co., New York City ... 218

LAVA GAS TIPS.

D. M. Steward Mfg. Co., Chattanooga, Tenn. ... 219

STREET LAMPS.

Welsbach Street Lighting Co., New York and Phila. ... 218

PURIFYING MATERIALS.

Connelly Iron Sponge and Governor Co., New York City 227
Greenpoint Chemical Works, Brooklyn, N.Y. ... 217
Henry W. Douglas, Ann Arbor, Mich ... 227
Gas Purification and Chemical Co., Ltd., London ... 227

EXHAUSTERS.

The P. H. & F. M. Roots Co., Connersville, Ind. ... 221
Isbell-Porter Company, New York City ... 234
Connelly Iron Sponge and Governor Co., New York City 227

VALVES.

Ludlow Valve Manufacturing Co., Troy, N. Y. ... 222
Chapman Valve Manufacturing Co., Boston, Mass. ... 222
R. D. Wood & Co., Phila., Pa. ... 234
Continental Iron Works, Brooklyn, N. Y. ... 234
The P. H. & F. M. Roots Co., Connersville, Ind. ... 221
Isbell-Porter Co., New York City ... 234
The Western Gas Construction Co., Fort Wayne Ind. ... 222

ELECTRICAL APPARATUS.

Wm. Henry White, New York City ... 235

GAS ENGINES.

Otto Gas Engine Works, Phila., Pa. ... 200
The American Gas Engine Co., Phila., Pa. ... 231
Backus Water Motor Co., Newark, N. J. ... 177

ENGINES AND BOILERS.

The Hazelton Boiler Company, New York City ... 217
W. G. & G. Greenfield, East Newark, N. J. ... 177

PURIFIER SCREENS.

John Cabot, New York City ... 219

GAS STOVES.

American Meter Co., New York and Philadelphia ... 223
Maryland Meter and Manufacturing Co., Baltimore, Md. 238
Keystone Meter Co., Royersford, Pa. ... 238
Wm. M. Crane & Co., New York City ... 218

GASHOLDER TANKS.

J. P. Whittier, Brooklyn, N. Y ... 226

GASHOLDERS.

Bartlett, Hayward & Co., Baltimore, Md. ... 233
Continental Iron Works, Brooklyn, N. Y. ... 234
Deily & Fowler, Philadelphia, Pa. ... 236
Davis & Farnum Mfg. Co., Waltham, Mass. ... 232
Kerr Murray Mfg. Co., Fort Wayne, Ind. ... 232
Stacey Mfg. Co., Cincinnati, Ohio ... 235
R. D. Wood & Co., Philadelphia, Pa. ... 234
Logan Iron Works, Brooklyn, N. Y. ... 236
Riter-Conley Co., Pittsburgh, Pa. ... 219

GAS SECURITIES.

Marquand & Parmly, New York City ... 217

BOOKS, ETC.

Scientific Books ... 228
Field's Analysis ... 239
Digest of Gas Cases ... 239
Directory of Gas Companies ... 237
Practical Photometry ... 230
Coal Tar Genealogical Tree ... 226
Management of Small Gas Works ... 226
Handbook on Gas Engines ... 233
Gas Flow Computers ... 226
Hughes' "Gas Works" ... 227

Position Wanted.

A practical gas man, who can construct a plant from the foundations up, desires a position as Superintendent of a small gas works, or will serve as Mechanic in large works. Can do both inside and outside work about a plant. Desires a plant that is run down, and will guarantee to make a model plant of same. Have tools, and will work for a moderate salary until ability is proven. Address

1183-1 "W. B. 27," care this Journal.

JOURNALS WANTED.

Parties having the following numbers of the AMERICAN GAS LIGHT JOURNAL for sale—viz., Mar. 2, April 2, May 2, 1883; Dec. 2 and 16, 1884; Jan. 2 and Nov. 2 and 16, 1885; Feb. 16, 1886—please address "CASH," care this Journal.

AN EXPERIENCED GAS ENGINEER AND CHEMIST

is open to accept immediate engagement; charge of works, or on the road. Experience in working inclined retorts. First-class references and testimonials. Address

1178 tf "M. R. S.," care this Journal.

MRS. HELEN ARMSTRONG,

Teacher of Cookery.

Demonstration Lectures for Gas Companies a Specialty.

Address

159 W. 66th St, Chicago, Ills.

WANTED,

A Second-Hand 5-Foot Station Meter,

with 6-inch connections—or one a little larger. Address, stating price and full particulars,

BENSON VAN VLIET,

1181-6 Poughkeepsie, N. Y.

For Sale.

A Small Gas and Electric Light Plant,

in a Southern city of 3,800 inhabitants.

Address FORT WAYNE ELECTRIC CORPORATION,

1097-tf Fort Wayne, Ind.

FOR SALE,

at a bargain,

Two 50-H P. Otto Gas Engines,

in first-class condition.

Address WOONSOCKET GAS CO.,

1175-tf Woonsocket, R. I.

FOR SALE.

Hydraulic, Dip, Branch and Ascension Pipes, Mouthpieces and Lids, for four Benches of 5's and for one Bench of 3 retorts.

Two Coolers, or Air Condensers, each of 150'000 cubic feet capacity.

Multitubular Condenser, shell, 36 in. diameter, with 98 2-in. tubes, 10 ft. 6 in. long.

D-Shaped Tar Extractor, 8 ft. long, 1 ft. 6 in. deep.

Scrubber, 48 in. diameter, 11 ft. 9 in. high. Three manholes, 11 in. by 15 in.

S-inch Center Seal. Four Purifiers, 8 ft. x 6 ft.

KEY CITY GAS CO

1119-tf Dubuque, Iowa.

VALUABLE GAS BUSINESS IN CALIFORNIA.

Concerning the best paying gas enterprises, covering two of the most rapidly growing cities in the United States, in which a valuable interest can now be secured, address for full information,

T. S. C. LOWE,

223 South Spring St., Los Angeles, Cal.

Note.—This is our Spring season, and the time to build and improve gas works on this coast. (1176-tf)

Utilize Your Gas Liquor.

NO EXTRA LABOR OR OPERATING EXPENSES.

Ammonia Concentrator,

Not Expensive. Write to

STROH & OSIUS, Pat'ees, or Mich. Ammonia Works, Detroit, Mich.

BRIDGES BERLIN BUILDINGS

OUR CATALOGUE

OF THREE HUNDRED PAGES ILLUSTRATING AND DESCRIBING A LARGE NUMBER OF

BRIDGES
BUILDINGS
AND ROOFS

Designed and Built by us Is now ready and will be sent on application.

THE BERLIN IRON BRIDGE CO.

EAST BERLIN, CONN.

HIGH-PRESSURE WATER-TUBE BOILERS

EQUIPPED WITH

SQUARE FURNACE, SQUARE GRATE SURFACE, STEEL JACKET, LINED WITH BRICK.

Single Boilers or Compact Batteries.

GREAT SAVING OF FUEL AND FLOOR SPACE.

A HIGH-CLASS BOILER WITH AN UNEQUALED RECORD.

Send for our New Book, "The Generation of Power."

The HAZELTON BOILER COMPANY,

Sole Proprietors and Manufacturers,

Builders of Stacks, Tanks and Miscellaneous Metal Work.

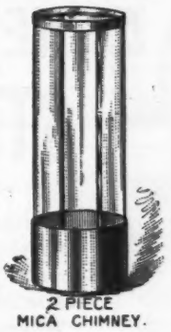
Cable Address, "Paila," New York. Tele., "1229—18th St." New York. Gen'l Office, 716 E. 13th St., N.Y., U.S.A.

MARQUAND & PARMLY,

160 Broadway, New York.

Members New York Stock Exchange.

Our Mica Chimneys



2 PIECE MICA CHIMNEY.

Etched Chimneys to Order.

For Welsbach Lights

ARE THE

BEST IN THE WORLD.

Get Catalog and Discounts.

The MICA MFG. CO

Micasmiths,

88 Fulton Street, N. Y. City.

Hoisting Engines . .

. . For Heavy Work.

Especially designed for our Coal Handling Apparatus, and so constructed as to drain off all condensation. No danger in starting. No danger of freezing. Built with extra large wearing parts.

C. W. HUNT COMPANY.

Coal Handling Machinery of Every Description.

FULL PARTICULARS FROM DEPT. "B." 45 BROADWAY, NEW YORK.

IRON MASS

For Gas Purification.

Acts immediately, and more efficiently than any other purifying agent now in use.

GREENPOINT CHEMICAL WORKS,

Greenpoint Ave. and Newtown Creek, Brooklyn, N. Y.

BRAY'S BURNERS

WILL PLEASE YOUR CONSUMER BETTER THAN ANY OTHER BURNER YOU CAN BUY.

They are made by people who have had many years of experience, in the largest and best equipped Burner Factory in the world.

Every Burner is stamped with name and trade mark. Cheap and inferior imitations are constantly coming in and going out of use. This kind of deception causes loss and discredit to the trade and damage to the gas industry.

As Sole Agents in the United States for GEORGE BRAY & CO., we carry a full stock of all sizes for High and Low Pressures. Send for Prices and Special Pamphlet, or order a sample gross, stating your average house pressure.

SPECIAL BURNERS MADE FOR ACETYLENE GAS.

In ordering your supplies for the season put in a liberal stock of Bray Burners. It will pay; the best is always desirable and cheapest in the end. Our line of Brass Fittings is of superior make and finish, and the assortment covers everything for Gas Fixtures and Gas Stoves. Our "Vulcan" brand of Patent End Tubing for Gas Stoves and Drop Lights is guaranteed. The price is higher, but it is worth the price.

When you want a Catalogue covering the most complete line of Gas Appliances, send to us.

When you want any special apparatus made, for using Gas as Fuel, state particulars, and it will be our pleasure to correspond with you.

We want your trade, and can be of service to you.

WE MAKE GAS APPLIANCES EXCLUSIVELY.

WILLIAM M. CRANE & CO., Mfrs., Factory, 447 to 453 W. 14th St., Office, 838 Broadway. **NEW YORK CITY.**

THE ANDERSON Patent Cutter Carrying Link
Made in all sizes.

Will cut from 2 in. to 24 in.
Pipe Cutting Tool

For Cutting Cast, Wrought Iron, Gas & Water Pipes.
THE ANDERSON PIPE CUTTER COMPANY, Manufacturers, 298 Lincoln St., Marlboro, Mass
N. Y. Office, 135 Greenwich St
C. H. TUCKER, JR., Manager.
WALDO BROS., 102 Milk Street, Boston, Mass.

F. BEHREND,
SOLE IMPORTER OF THE CELEBRATED
German (Stettin-Didier) Clay Gas Retorts,
BLOCKS, TILES, FIREBRICKS, FIRE CEMENT,
Stettin "Anchor" & "Eagle" Brand Portland Cement
10 & 12 Old Slip, New York.

NEW YORK, 33 NASSAU ST. PHILADELPHIA, 246 N. BROAD ST. CHICAGO, 54 LAKE ST.

WELSBACH STREET LIGHTING COMPANY OF AMERICA,

—OWNS, CONTROLS AND OPERATES—
EXCLUSIVELY

THE NEW IMPROVED AND PATENTED STREET LIGHT BURNER.

STYLE No. 81.

Our PATENTED "STREET LIGHT APPLIANCES" have made WELSBACH STREET LIGHTING a complete success.

By the UNIFORM DISTRIBUTION of light on scientific principles a greater area can be lighted by our system and more economically than in any other way.

Where there are no gas mains already laid, we can furnish an equally good light by our **SELF-GENERATING NAPHTHA WELSBACH BURNER,** enabling Gas Companies to furnish a uniform light in all localities.

Lists of Cities and Towns in which we are now lighting under contract will be furnished upon application.

STYLE No. 97.

CORRESPONDENCE SOLICITED FROM GAS COMPANIES AND OTHERS INTERESTED IN MUNICIPAL LIGHTING.

THE Patent "Standard" Washer-Scrubber

(U. S. A. Patent, No. 486.927 of 29–11–'92.)

Order Recently Received—16 Machines, each for 3,500,000 Cubic Feet per day.

The Patentees of the above, after several years' experience, finding that the enormous weight of the iron sheets (forming the washing discs) caused undue wear of the shafts and consequent fractures of the latter, introduced their Patent Wooden "Grid Segments." These "segments" have now been fitted in some hundreds of Patent "Standard" Washer-Scrubbers, and are universally admitted to be a great improvement upon the out of date pattern.

The Patentees beg to refer Engineers to recent issues of the AMERICAN GAS LIGHT JOURNAL for testimonials as to the efficiency of their improvements and will be glad to quote for complete machines or for "grid segments" for fitting in old pattern Washer-Scrubbers, the manufacture to be English or American at enquirer's option. If for any *special reason* iron sheets are preferred, the Patentees will quote for them, but they do not recommend same.

KIRKHAM, HULETT & CHANDLER, Limited,

3 & 4 Palace Chambers, Bridge Street, Westminster, England.

Tel. Address: "WASHER, LONDON."

RITER-CONLEY COMPANY,

GASHOLDERS, with or without Steel Tanks.

Purifiers, Condensers, Scrubbers, Oil Tanks, Smoke Stacks.

STEEL ROOFS and BUILDINGS.

PLATE AND STRUCTURAL WORK OF EVERY DESCRIPTION.

GENERAL OFFICE: Pittsburg, Pa. **EASTERN OFFICE: 39-41 Cortlandt St., New York City.**

THE GREATEST IMPROVEMENT IN GAS LIGHTING
Has been made by
WILDER'S VOLUMETRIC GOVERNORS.

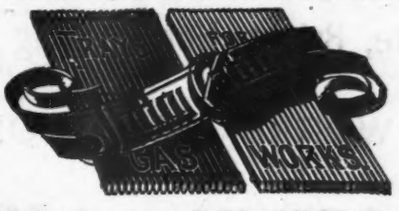
They control the pressure at the burner, and deliver the quantity for which they are set regardless of high or low pressure in the supply.

WELSBACH LIGHTS are fully controlled, and the governors soon pay for themselves by preventing the breaking of mantles and chimneys. Thousands are already in use. Orders may be given to the Welsbach Co., or sent to ourselves.

THE WILDER MANFG. CO., - - 818 Cherry St., PHILADELPHIA.

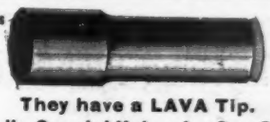
BRISTOL'S RECORDING
PRESSURE GAUGE.
For continuous records of **Street Gas Pressure**
Simple in Construction, Accurate in Operation Low in Price.
Fully Guaranteed. Send for Circulars.
The Bristol Co.,
Waterbury, Conn.

Special Trays for Iron Sponge or Oxide of Iron.
CHURCH'S TRAYS a Specialty.
Reversible, Strongest, Most Durable, Most Easily Repaired



553-557 West Thirty-third Street, New York.
We also make the Cheapest and Strongest REVERSIBLE BOLTED TRAYS IN THE MARKET.
Send for Circulars.

3 pressures always in stock.



H – 25/10
M – 15/10
L – 8/10

They have a LAVA Tip.
Steward's Special Union Jet Gas Burners.
Now in use by the Largest Gas Companies in the U. S.
THE D. M. STEWARD MFG. CO.,
CHATTANOOGA, TENN.

Practical Hints
ON THE CONSTRUCTION AND WORKING OF
Regenerator Furnaces,
By MAURICE GRAHAM, C.E.
Price $1.25.
A. M. CALLENDER & CO., 32 Pine Street, N.Y.

AMERICAN GAS COMPANY

Constructors of Coal Gas Apparatus.

KLONNE-BREDEL

Recuperative Furnaces, Washers, Condensers, Purifiers and Purifying Machines, Ammonia Plant, Coke Conveyers, Etc.

Complete Works Erected with Guaranteed Results.

EASTERN AGENTS FOR

FRED. BREDEL'S SYSTEM
COAL GAS PLANTS AND GAS APPARATUS.

P. H. & F. M. ROOTS CO.'S
Exhausters, Blowers, etc.

222 South Third Street, Philadelphia, Pa.

GEORGE G. RAMSDELL, General Manager. **Correspondence Solicited**

FRED. BREDEL, C.E.

Coal and Water Gas Plants,

OWN SYSTEM.

Recuperative Furnaces, Washers, Condensers, Purifiers, Purifying Machines.

Gas Enriching Plants to Enrich Coal Gas up to 24 Candle Power, and Making a White, Bright, Non-smoking Gas.

COMPLETE GAS WORKS, COKE CONVEYERS, ETC.

No. 118 Farwell Avenue, · · Milwaukee, Wis.

Eastern Agents: AMERICAN GAS CO., Construction Department, 222 So. 3d St., Phila., Pa.

ROOTS'

LATEST IMPROVED GAS EXHAUSTER

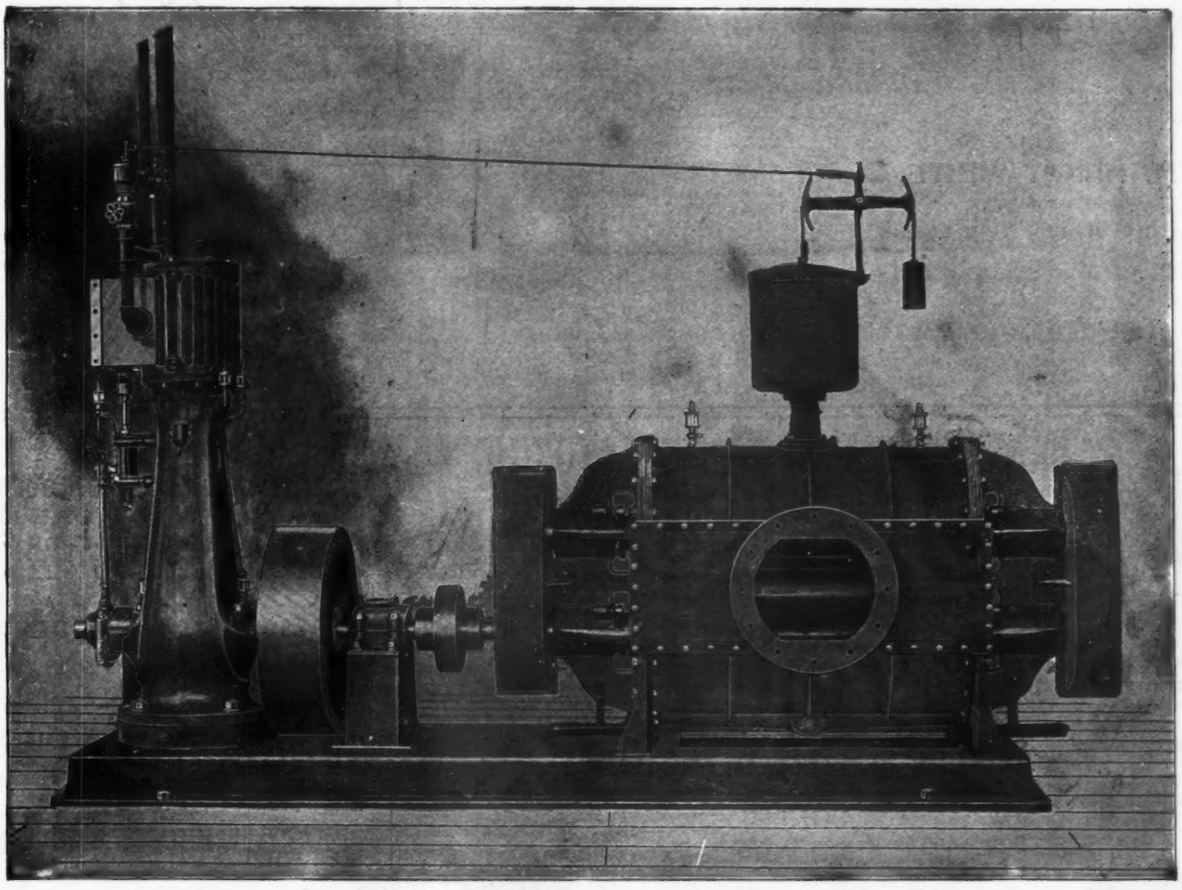
—AND—

NEW GAS GOVERNOR AND STEAM VALVE.

GUARANTEED TO REGULATE WITHIN ONE-TENTH OF AN INCH, WATER PRESSURE.

The Most Perfect Gas Governor on the Market.

MORE DIRECT IN ACTION. FEWER PARTS.
EASIER TO ADJUST THAN ANY OTHER GOVERNOR.



INQUIRIES CHEERFULLY ANSWERED. WRITE FOR CATALOGUE.

P. H. & F. M. ROOTS CO.

Connersville, Ind. 109 Liberty St., New York.

Eastern Office:

American Gas Company,

222 South Third Street, Philadelphia, Pa.

Fort Wayne, Indiana.

THE WESTERN GAS CONSTRUCTION COMPANY.

Improved Lowe Water Gas Apparatus.
Coal Gas Apparatus and Machinery.
Gas Valves and Specials.
American Kilmarnock Gas Engine.

WM. HENRY WHITE,
EASTERN AGENT,
32 Pine Street, New York.

CHAPMAN VALVE MANUFACTURING CO.,

MANUFACTURERS OF

Valves and Gates for Gas, Ammonia, Water, Etc.

Also, Gate Fire Hydrants with and without Independent Nozzle Valve. All Work Guaranteed.

Works & Gen'l Office, Indian Orchard, Mass. Treasurer's Office, 72 Kilby & 112 Milk Sts., Boston, Mass.
Chicago Office, 24 West Lake St. New York Office, 28 Platt St.
St. Louis Office, L. M. Rumsey Mfg. Co., 810 North Second St.

THE

Ludlow Valve Mfg. Co.,

TROY, N. Y., U. S. A.

Double and Single Gate Valves, ¾" to 72"

—FOR—

Gas, Water, Steam, Oil, Ammonia, Etc.

HOT GAS VALVES A SPECIALTY.

Send for Catalogue.

GASHOLDER TANKS AND GAS WORKS MASONRY COMPLETE

Plans prepared and Estimates furnished at short notice.

J. P. WHITTIER,

70 Rush St. Near Division Ave., Brooklyn, N. Y.

The Gas Engineer's Laboratory Handbook.

By JOHN HORNBY, F.I.C.

Price, $2.50.

A. M. CALLENDER & CO., 32 Pine Street, N.Y. City.

Practical Photometry.

A GUIDE TO THE STUDY OF THE MEASUREMENT OF LIGHT.

By William Joseph Dibdin.

Price, $3.00.

A. M. CALLENDER & CO.,

32 Pine Street, N. Y. City.

BOOKS.

DISTILLATION OF COAL TAR AND AMMONIACAL LIQUOR.

By George Lunge. Price $12.50.

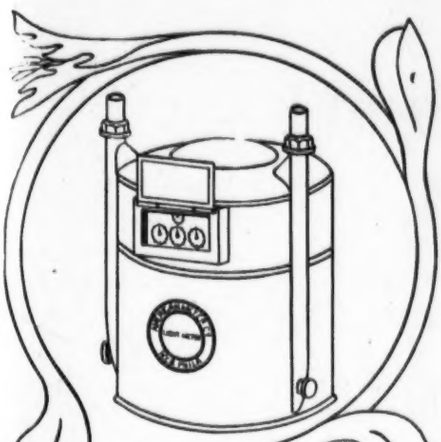
TREATISE ON THE COMPARATIVE COMMERCIAL VALUES OF GAS COALS AND CANNELS.

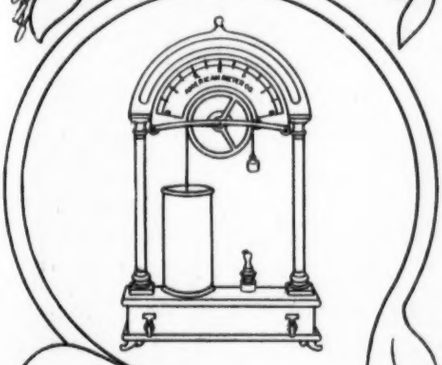
By David A. Graham. 8vo., Cloth. Price $3.

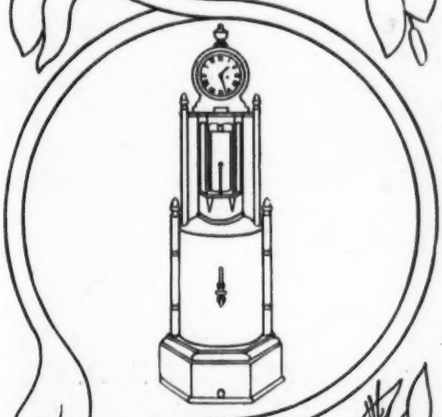
Orders for these books may be sent to this office.

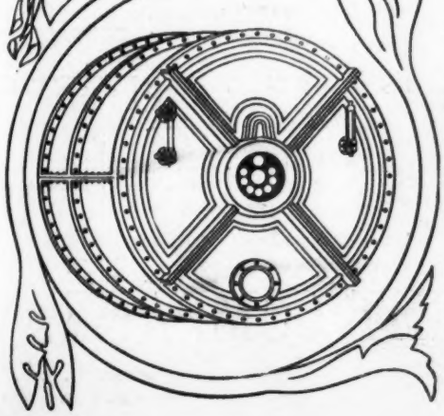
A. M. CALLENDER & CO.,

Pine St., N. Y. City









(Copyrighted, 1894, by the AMERICAN METER CO.

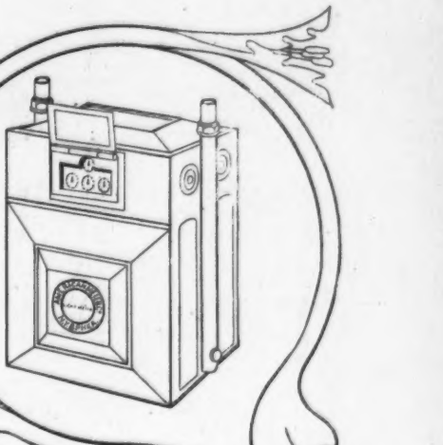
AMERICAN METER CO.

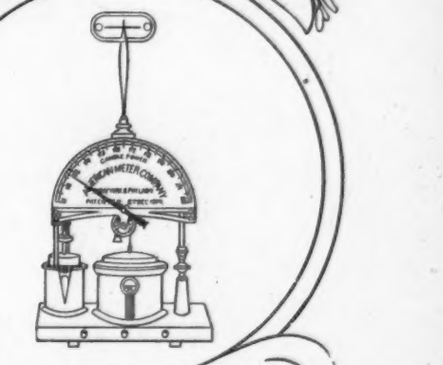
ESTABLISHED 1834. INCORPORATED 1868.

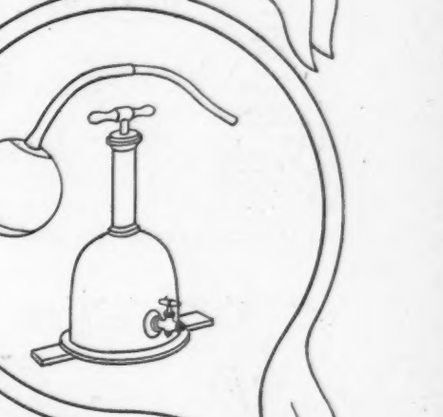
NEW YORK AND PHILADELPHIA,

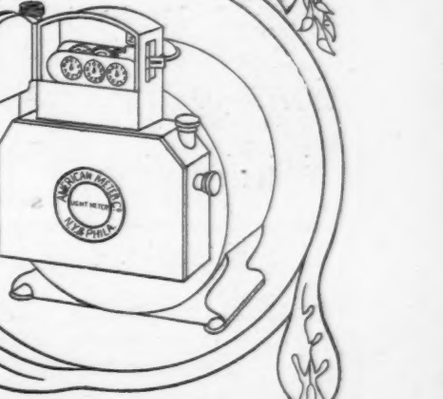
CHICAGO, ST. LOUIS,

SAN FRANCISCO.









PUBLIC LIGHTING TABLE.

FEBRUARY, 1898.

Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Following the Moon. Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Table No. 2. New York City. All Night Lighting. Extinguish.
				P.M.	A.M.
Tue.	1	3.20 AM	6.10 AM	5.05	6.15
Wed.	2	4.10	6.10	5.05	6.15
Thu.	3	4.50	6.10	5.05	6.15
Fri.	4	5.20	6.10	5.05	6.15
Sat.	5	No L.	No L.	5.10	6 10
Sun.	6	No L. FM	No L.	5.10	6.10
Mon.	7	No L.	No L.	5.10	6.10
Tue.	8	6.00 PM	8.40 PM	5.10	6.10
Wed.	9	6.00	9.50	5.10	6.10
Thu.	10	6.00	11.00	5.10	6.10
Fri.	11	6.00	12.10 AM	5.10	6.10
Sat.	12	6.00	1.20	5.20	5.55
Sun.	13	6.10 LQ	2.30	5.20	5.55
Mon.	14	6.10	3.40	5.20	5.55
Tue.	15	6.10	4.40	5.20	5.55
Wed.	16	6.10	5.40	5.20	5.55
Thu.	17	6.10	5.50	5.20	5.55
Fri.	18	6.10	5.50	5.20	5.55
Sat.	19	6.10	5.50	5.30	5.55
Sun.	20	6.20 NM	5.40	5 30	5.55
Mon.	21	6.20	5.40	5.30	5.55
Tue.	22	6.20	5.40	5.30	5.55
Wed.	23	6.20	5.40	5.30	5.55
Thu.	24	6.20	5.40	5.30	5.55
Fri.	25	10.20	5.40	5.30	5.55
Sat.	26	11.20	5 40	5.30	5.45
Sun.	27	12.20 AM FQ	5.30	5.30	5.45
Mon.	28	1.10	5.30	5.30	5.45

TOTAL HOURS LIGHTING DURING 1898.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	210.40	January	423.20
February	186.40	February	355.25
March	181.20	March	355.35
April	166.10	April	298.50
May	156.40	May	264.50
June	144.30	June	234.25
July	147.30	July	243.45
August	157.10	August	280.25
September	169.50	September	321.15
October	186.00	October	374.30
November	204.30	November	401.40
December	218.30	December	433.45
Total, yr.	2129.30	Total, yr.	3987.45

$500.00 Reward!

THE PUBLIC IS CAUTIONED that imitation and worthless incandescent burners and mantles are being sold by unscrupulous dealers on the representation that they are the genuine "Welsbach."

THE WELSBACH LIGHT COMPANY will pay $500.00 reward for the arrest and conviction of any person representing and selling incandescent burners or mantles as genuine "Welsbachs" that do not bear our trade-mark.

All genuine Welsbach lights have stamped on the brass work "Welsbach System, Patented," and all genuine Welsbach mantles are branded with our trade-mark, "J," and both burners and mantles are sold in boxes bearing our trade name, "Welsbach."

All other incandescent gas lamps and mantles are infringements of this Company's patents, notwithstanding representations to the contrary, and all manufacturers, sellers or USERS of infringing burners or mantles are liable to be and will be prosecuted.

WELSBACH LIGHT COMPANY.

STANDARD

DOUBLE-SUPERHEATER LOWE WATER GAS APPARATUS.

Number of Installations to Date, - - 241

Total Daily Capacity, 128,825,000 Cu. Ft.

The United Gas Improvement Company,

DREXEL BUILDING, PHILA., PA.

ALEX. C. HUMPHREYS, M. E.,
BANK OF COMMERCE BUILDING,
(31 NASSAU STREET,)
NEW YORK.

CABLE ADDRESS,
LONDON & NEW YORK,
"HUMGLAS."

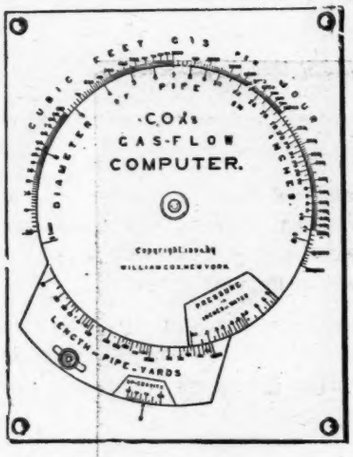
ARTHUR G. GLASGOW, M.E.,
9 VICTORIA ST.,
LONDON, S. W.,
ENGLAND.

HUMPHREYS & GLASGOW,

CONTRACTING AND CONSULTING

GAS ENGINEERS.

WATER GAS PLANT A SPECIALTY.
GAS PROPERTIES EXAMINED AND VALUED.
ADVICE AS TO IMPROVEMENT OF GAS PROPERTIES AND MANAGEMENT.



Do you wish to Know

what size of Pipe to use to convey any quantity of Gas, any distance, with any loss of pressure, and any initial or final pressure? Then use

COX'S GAS FLOW COMPUTER,

as it gives this information accurately at sight, without mental effort. No calculations needed. Saves time, money and mistakes.

Price, 12 x 14 inches, on wooden board, $5.00.

For sale by

A. M. CALLENDER & CO., 32 Pine St., N. Y. City.

Coal Tar Genealogical Tree

MR. T. VINER CLARKE, of London, Eng.,

Having compiled a novel Chart or Map illustrating the various

CHEMICAL PRODUCTS DERIVED FROM COAL AND COAL TAR,

In the form of a Genealogical Tree, including all the products discovered to date (the total number amounting to near 700), offers for sale a limited number of copies in Colors, mounted on Linen, with Rollers. Price, $3.50. Orders may be sent to

A. M. CALLENDER & CO., - - No. 32 Pine Street, New York.

THE MANAGEMENT OF SMALL GAS WORKS.

By C. J. R. HUMPHREYS.

Price $1.

A. M. CALLENDE & CO., No. 32 Pine Street New York

NATIONAL GAS AND WATER CO.,

218 La Salle Street, Chicago.

Builder and Operator of Gas Works.

The Rew Soft Coal Carbureted Water Gas Apparatus.

TESTED BY THREE YEARS' PRACTICAL OPERATION, AND FULLY GUARANTEED.

Plans and Estimates Upon Application.

IRWIN REW, President and Treasurer. E. E. MORRELL, Engineer.

CONNELLY IRON SPONGE AND GOVERNOR CO.,

(Successors to CONNELLY & CO.)

MANUFACTURERS OF GAS WORKS SPECIALTIES.

"IRON SPONGE." Saves money, saves labor, and is the most efficient purifying material ever offered as a substitute for lime. We guarantee a large saving, both in cost of material and labor.

AUTOMATIC GOVERNOR. OVER FOUR HUNDRED NOW IN USE! NO WORKS COMPLETE WITHOUT IT! WILL PAY FOR ITSELF WITHIN A YEAR! ITS SERVICE SECURES PERFECT DISTRIBUTION! REDUCES LEAKAGE TO MINIMUM, and BENEFITS THE COMPANY and CONSUMER ALIKE! IT IS THE ONLY RECOGNIZED AUTOMATIC GOVERNOR IN THE WORLD!

STEAM JET EXHAUSTER. Designed particularly for small works. Combines Exhaust Tube, Steam Governor, Gas Compensator and Bye-Pass Valves in the most compact form possible. Occupies but little space; uses very little steam; saves formation of carbon in retorts; increases yield 10 to 15 per cent. No works too small to use them profitably.

Prices given on all our specialties, delivered at any point in the United States. Correspondence solicited.

CONNELLY IRON SPONGE AND GOVERNOR CO., No. 357 Canal St., New York.

Hughes' "Gas Works,"

Their Construction and Arrangement,

And the Manufacture and Distribution of Coal Gas.

Originally written by SAM'L HUGHES, C.E.

Rewritten and Much Enlarged by WM. RICHARDS, C.E.

Eighth Edition, Revised, with Notices of Recent Improvements.

Price, $1.65.

A. M. CALLENDER & CO., 32 Pine St., N. Y. City.

DOUGLAS' FERRIC OXIDE

For Gas Purification

Is a superior natural Hydrated Oxide of Iron. Will give a higher purification per bushel than any other material. We ship the pure Oxide of Iron, containing no sawdust, thus effecting a saving in freight, leaving the consumer to furnish the diluent at a nominal cost. It is now used by the largest gas companies in the West.

Full information, with references to many users, and prices delivered in any locality, furnished on application to

H.W. Douglas (Supt. Ann Arbor Gas Company) Ann Arbor, Mich.

ONEILL'S OXIDE,

(NATURAL BOG ORE)

For Gas Purification.

Has the Largest Annual Sale of Any Oxide in the World.

GAS PURIFICATION AND CHEMICAL CO., LTD.,

160, 161, 162 Palmerston Buildings,

Old Broad St., London, E.C., Eng.

Parson's Steam Blower,

FOR IMPROVING BAD DRAUGHT IN BOILERS, AND FOR BURNING BREEZE OR OTHER WASTE MATERIAL.

PARSON'S TAR BURNER.

FOR UTILIZING COAL TAR AS FUEL.

PARSON'S AIR JET TUBE CLEANER.

FOR CLEANING BOILER TUBES.

These devices are all first-class. They will be sent to any responsible party *for trial*. No sale unless satisfactory. Manufactured by the WATERTOWN STEAM BLOWER COMPANY

H. E. PARSON, Supt., 67 Bremen Street, Brooklyn, N. Y.

JAMES D. PERKINS. **PERKINS & CO.,** F. SEAVERNS.

228 and 229 Produce Exchange, New York City.

TIDEWATER SALES AGENTS FOR THE FOLLOWING:

Ocean Mine Youghiogheny Gas Coal,

Clinch Valley, Thacker & Logan Gas Coals

Old Kentucky Shale and O. K. Boghead.

Shipments from New York, Philadelphia, Baltimore and Norfolk.

BERWIND-WHITE COAL MINING COMPANY'S

Ocean Westmoreland Gas Coal.

Offices:

Washington Building, New York.

Betz Building, Philadelphia.

STRICTLY High Grade. . . . .
Carefully prepared.
For Gas Making or
Heavy Steaming.

SCIENTIFIC BOOKS.

GAS MANUFACTURE, by William Richards. 4to., with numerous Engravings and Plates, in Cloth binding. $12.

TECHNICAL GAS ANALYSIS. $3.

GAS CONSUMER'S HANDYBOOK, by Wm. Richards, C.E. 20 cents.

CHEMISTRY OF ILLUMINATING GAS. By Norton H. Humphrys. $2.40.

PRACTICAL TREATISE ON HEAT By Thomas Box. 2d edition. $5.

PRACTICAL PHOTOMETRY: A Guide to the Study of the Measurement of Light. By W. J. Dibdin. $3.

CHEMICAL TECHNOLOGY: Vol. I., *Fuel and Its Applications*, $5. Vol. II., *Lighting*, $4.

IRONWORK: Practical Designing of Structural Ironwork. By H. Adams. $3.50.

GAS WORKS: Their Arrangement, Construction, Plant and Machinery. $5.

PRACTICAL HANDBOOK ON GAS ENGINES, by G. Lieckfield. $1.

LIQUID FUEL FOR MECHANICAL AND INDUSTRIAL PURPOSES. By E. A. Brayley Hodgetts. $2.50.

COAL, SPONTANEOUS COMBUSTION OF. By Thomas Rowan, C.E. $2.

COAL: Its History and Use. By Prof. Thorpe. $3.50.

THE GAS WORKS OF LONDON. By Colburn. 60 cents.

HEAT A MODE OF MOTION. By John Tyndall. $—

THE MANAGEMENT OF SMALL GAS WORKS. By C. J. R. Humphreys. $1.

MANUAL FOR GAS ENGINEERING STUDENTS. By D. Lee. 40 cents.

THEORY OF HEAT. By J. Clerk-Maxwell. $1.50.

GASFITTER'S GUIDE, by John Eldridge 40 cents.

AMMONIA AND AMMONIUM COMPOUNDS. By Dr. R. Arnold. $2

CONSTRUCTION OF GAS WORKS, by Walter Ralph Herring. $2.

DIGEST OF GAS CASES. $5.

PRACTICAL HINTS ON REGENERATOR FURNACES By M. Graham. $1.25.

DISTILLATION OF COAL TAR AND AMMONIACAL LIQUOR. By Geo. Lunge. New edition. $12.50.

A TREATISE ON THE COMPARATIVE COMMERCIAL VALUES OF GAS COALS AND CANNELS. By D. A. Graham. $3.

A TEXT BOOK OF INORGANIC CHEMISTRY. By Prof. Victor Von Richter. $2.

ILLUMINATING AND HEATING GAS. By W. Burns. $1.50

HANDBOOK FOR MECHANICAL ENGINEERS. By H. Adams. $2.50.

TREATISE ON MASONRY CONSTRUCTION. Baker. $5

GAS ENGINEER'S LABORATORY HANDBOOK. By Jno. Hornby, F.I.C. $2.50.

GAS LIGHTING AND GAS FITTING. By W. P. Gerhard. 50 cents.

PRACTICAL PLUMBING. By P. J. Davies. $3.

GAS MANUFACTURE, THE CHEMISTRY OF, by W. J. A. Butterfield. $3.50.

AMERICAN PLUMBING. By Alfred Revill. $2.

CEMENT: A Manual of Lime and Cement, their Treatment and Use in Construction. By A. H. Heath. $2.50.

ELECTRICITY.

INDUSTRIAL PHOTOMETRY, with Special Application to Electric Lighting. By A. Palaz, Sc.D. $4.

ELEMENTS OF ELECTRIC LIGHTING, Including Electric Generation, Measurement, Storage and Distribution. By Philip Atkinson. $1.50.

ELECTRIC TRANSMISSION OF ENERGY. By G. Knapp. $3.50.

ELECTRICIAN'S POCKETBOOK. By Monroe and Jamieson. $2.50.

MAGNETISM AND ELECTRICITY. By J. Overend. 40 cts.

DYNAMO BUILDING. By F. W. Walker. 50 cents.

DOMESTIC ELECTRICITY FOR AMATEURS. By E. Hospitalier. $2.50.

PRACTICAL MANAGEMENT OF DYNAMOS AND MOTORS. $1.

PRACTICAL GUIDE TO THE TESTING OF INSULATED WIRES AND CABLES. $1.

ELECTRIC LIGHTING, by Francis B. Crocker, E.M. $3.

ELECTRIC LIGHT FITTING. $2.

PRACTICAL ELECTRICITY. $2.50.

ELECTRICITY FOR ENGINEERS. $2.50.

ELECTRICITY, Its Theory, Sources and Applications. By John T. Sprague, M.I.E.E. $6.

The above will be forwarded upon receipt of price. If sent by mail or express, postage or express charges must be added to above prices. We take especial pains in securing and forwarding any other Works that may be desired, upon receipt of order. All remittances should be made by check, draft, or post office money order No books sent C.O.D.

A. M. CALLENDER & CO., 32 Pine Street, New York.

The Despard Gas Coal Co.,

MINERS AND SHIPPERS OF

DESPARD GAS COAL,

AND MANUFACTURERS OF

COKE.

MINES, - - Clarksburgh, Harrison Co., West Va.
WHARVES, - - - Locust Point, Baltimore, Md.
OFFICE, - 640 Equitable Building, Baltimore, Md.

ROUSSEL & HICKS, 71 Broadway, N. Y. } AGENTS, { BANGS & HORTON, 60 Congress St., Boston.

W. D. ALTHOUSE & CO.

Reading Terminal—Philadelphia.

"Shaner," Westmoreland, Pa.

HIGH GRADE GAS COAL

AND

KENTUCKY CANNELS.

KELLER ADJUSTABLE COKE CRUSHER.

Strong, Simple, Durable. Will Crush any Size Desired.

C. M. KELLER,
Sec. & Supt. Gas Lt. & Coke Co.,
Columbus, Ind.
Correspondence Solicited.

GREENOUGH'S "DIGEST OF GAS CASES."

Price, $5.00.

This is a valuable and important work, a copy of which should be in the possession of every gas company in the country, whether large or small. As a book of reference it will be found invaluable. It is the only work of the kind which has ever been published in this country, and is most complete. Handsomely bound. Orders may be sent to

A. M. CALLENDER & CO., 39 Pine St., N. Y.

— THE —

PENN GAS COAL CO.

OFFER THEIR

Coal, Carefully Screened and Prepared for Gas Purposes.

Their property is located in the Youghiogheny Coal Basin, near Irwin and Penn Stations on the Pennsylvania Railroad, and on the Youghiogheny River.

Principal Office:

Room 720, Reading Terminal Building, Phila., Pa.

Points of Shipment:

Pennsylvania Railroad Piers; Greenwich Wharves, Delaware River; Pier No. 1 (Lower Side), South Amboy, N. J.

EDMUND H. MCCULLOUGH, Prest. CHAS. F. GODSHALL, Treas. H. C. ADAMS, Sec.

THE WESTMORELAND COAL CO.

Chartered 1854.

Mines situated on the Pennsylvania and the Baltimore and Ohio Railroads, in Westmoreland County, Pa.

POINTS OF SHIPMENT:

PHILADELPHIA, BALTIMORE, SOUTH AMBOY, N. J.,
WATKINS (SENECA LAKE), N. Y.

Since the commencement of operations by this Company its well-known Coal has been largely used by the Gas Companies of New England and the Middle States, and its character is established as having no superior in gas-giving qualities, and in freedom from sulphur and other impurities.

Principal Office, 224 South 3d St., Phila., Pa.

THE SUN OIL CO.,

Crude Oil, Gas Naphtha,
Refined Petroleum, Gas Oil.

Toledo, O., and Pittsburgh, Pa.

Standard Oil Company,

GAS NAPTHA DEPARTMENT.

GAS NAPTHA.

GAS OIL.

Correspondence Solicited.

26 Broadway, New York City,

Established 1858. Incorporated 1890.
CHAS. E. GREGORY Prest. DAVID R. DALY V. Prest. & Treas.
H. D. ABERNETHY, Sec.

J. H. Gautier & Co.

Greene & Essex Streets,
Jersey City, N. J.

MANUFACTURERS OF

CLAY GAS RETORTS, FIRE CLAY TILES,
FIRE BRICK and FIRE CLAY SPECIALTIES

Ground Fire Clay, Fire Sand and Ground Fire Brick in Barrels and Bulk.

SOLE MANUFACTURERS OF THE

FLEMMING GENERATOR GAS FURNACE

Brooklyn Fire Brick Works,

MANUFACTURERS OF

CLAY RETORTS, FIRE BRICK,
Gas House and other Tile.

Office, 88 Van Dyke St., Brooklyn, N. Y.

Established 1854. Incorporated 1869.

LACLEDE
Fire Brick Manufg. Co.,

Manufacturers of { GAS RETORTS . .
FIRE BRICK . . .
RETORT SETTINGS

Water Gas Cupola Linings, Fire Clay, Etc.

Exclusive Agents for

The Mitchell Half-Depth Regenerative Furnace.

This is the *original* coal-consuming Furnace for Retort Benches. Burns either Coal or Coke. Full and Half-Depth Regenerative Furnaces for Benches of 6's, 7's, 8's or 9's erected complete.

Proprietors of the Coze System of Inclined Retorts.

Office: 801 Pine St., **St. Louis, Mo.**

ESTABLISHED IN 1845.

B. KREISCHER & SONS,

Office, 119 E. 23d St., New York.

Gas Retorts,

TILES, FIRE BRICK.

AND EVERYTHING IN THE FIRE CLAY LINE.

Adam Weber,

Proprietor,

Manhattan Fire Brick and Enameled Clay Retort Works.

Works, Weber, N. J.

Office, 633 East 15th St., New York.

Modern Recuperative Furnaces

And Standard Fire Brick and Gas Retorts.

Works,
LOCKPORT STATION, PA.

—ESTABLISHED 1864.—

JAMES GARDNER, JR.,

Hamilton Building, Fifth Avenue,
PITTSBURGH, PA. P. O. Box 373

Successor to WILLIAM GARDNER & SON

Fire Clay Goods for Gas Works.

SOLE REPRESENTATIVE OF THE McILHENNY REGENERATIVE BENCHES FOR THE U. S.

HENRY MAURER & SON,

(ESTABLISHED 1856.)

EXCELSIOR FIRE BRICK & CLAY

RETORT WORKS

WORKS, Perth Amboy, N. J.
OFFICE, 418 to 422 East 23d St., N. Y

Clay Gas Retorts,

BENCH SETTINGS,

Fire Brick, Tiles, Etc.

GEROULD'S IMPROVED RETORT CEMENT.

A Cement of great value for patching retorts, putting on mouth-pieces, making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick.

PRICE LIST.

In Casks, 400 to 800 pounds, at 5 cents per pound.
In Kegs, 100 to 200 " " 6 " "
In Kegs less than 100 " " 7 " "

C. L. GEROULD & CO.,

N. 3d & Prospect Avs., Mt. Vernon, N.Y.

Western Agent, H. T. GEROULD, Centralia, Ills.

Parker-Russell Mining and Mfg. Co.,

CITY OFFICE,
417 Pine Street, St. Louis, Mo.

PROPRIETORS OF THE

OAKHILL GAS RETORT & FIRE BRICK W'KS

Our immense establishment is now employed almost entirely in the manufacture of

Materials for Gas Companies

We have studied and perfected three important points. Our retorts are made to stand changes of temperature, the strongest heats of the furnace, and the abrasion of feeding and emptying. We construct

Half and Full Depth Benches of Our Own Design,

Containing 6, 8 or 9 Retorts.

We have Greatly Improved our Recuperators. Coal or Coke can be used as Fuel in Furnaces.

THEO. J. SMITH, Prest. J. A. TAYLOR, Sec'y
A. LAMBLA, Vice-Prest. and Supt.

BALTIMORE

RETORT & FIRE BRICK CO.

MANUFACTORY AT

LOCUST POINT BALTIMORE MD.

Clay Retorts, Blocks & Tiles

FIRE BRICK, FIRE CLAY,
AND FIRE CEMENT.

Red and Buff Ornamental Tiles and Chimney Tops. Baker Oven Tiles 12x12x2 and 16x16x2.

WALDO BROS., 102 MILK ST., BOSTON, MASS.

Sole Agents for New England States.

PRACTICAL PHOTOMETRY.

A Guide to the Study of the Measurement of Light.

By WILLIAM JOSEPH DIBDIN.

With Numerous Illustrations. Price, $3.00. A. M. CALLENDER & CO., 32 Pine Street, N. Y. City

WM. W. GOODWIN, Prest. O. N. GULDLIN, V.-Prest. & Treas. H. B. GOODWIN, Sec. ERNEST F. LLOYD, Asst. Sec

THE AMERICAN GAS ENGINE CO.,

MANUFACTURERS OF

The Double-Acting Gas Engine,

Under the Patents of Griffin, and Dick, Kerr & Co., of London and Kilmarnock.

**

Single Cylinder.

Impulse Every Revolution.

(Two Strokes.)

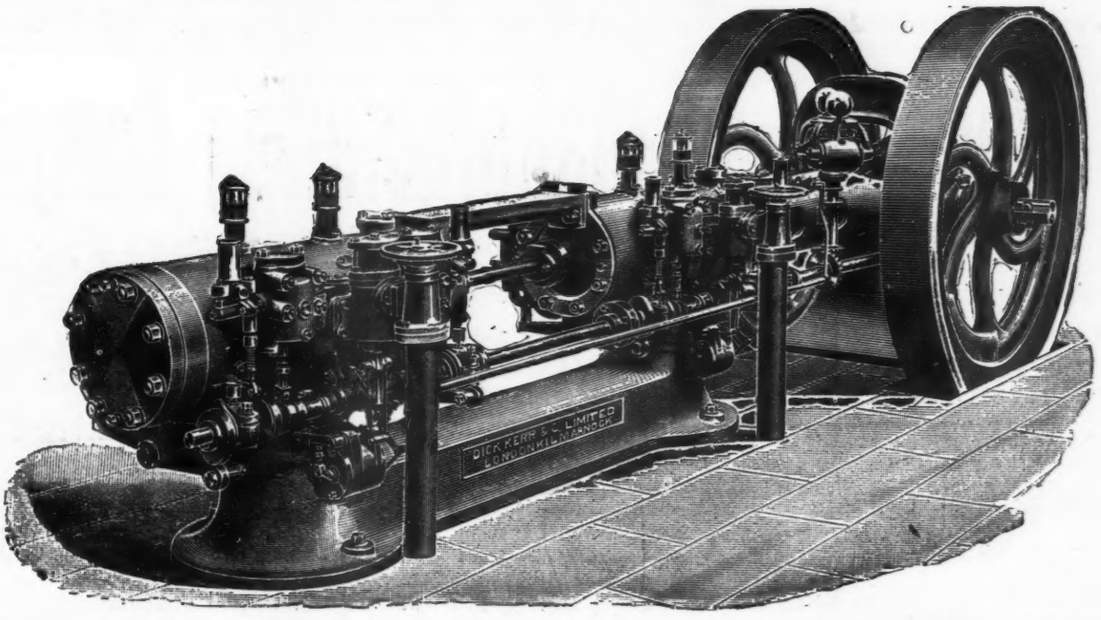
15 to 500 Horse Power

For General Work and Isolated Electric Plants.

**

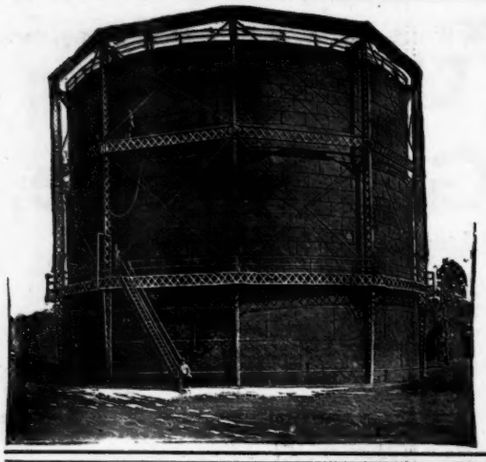
Tandem Cylinder. Impulse Every Stroke 100 to 1,000 Horse Power.

For Central Stations and all work requiring extreme steadiness.



ESSENTIAL PRINCIPLE.—An impulse at each end of piston; using half force to each impulse; doubling the steadiness; reducing the wear on moving parts, and weight for given power. **CONSTRUCTION.**—The piston rod works through stuffing box in front end of cy inder, and connecting rod is carried in a cross-head working in a slide in frame, as in ordinary steam engine practice. All valves are of the poppet type, operated by cams on a single cam-shaft, giving positive movement to every working part. Tube or electric ignition. **RESULT.**—An engine of extreme simplicity and steadiness of action, the even wear on the cylinder and all working parts assuring increased economy, long life, and minimum cost in repairs. **RECORD.**—Successful and constant use in Great Britain for the past eight years. Address

W. W. GOODWIN, President, 532 Bourse Building, Philadelphia Pa. or
THE WESTERN GAS CONSTRUCTION CO. Bldrs. & Gen. Agts. Fort Wayne Ind.



DAVIS & FARNUM MFG. CO.,

WALTHAM, MASS.

Principal Office & Works, Waltham, Mass. Boston Office, R'm 18, Vulcan Bldg., 8 Oliver St.

Single, Double and Triple-Lift Gasholders of any Capacity. Tubular, Pipe and Sinuous Friction Condensers of all Sizes.

Steel Tanks for Gasholders, Iron Roof Frames and Floors, Purifying Boxes, Center Seal or Valve Connections, Bench Work, Reversible Lime Trays.

Self-Sealing and Pressed Steel Mouthpiece Lids.

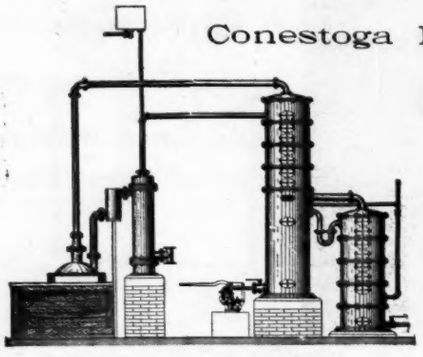
Coke Borrows, Coal Wagons, and all Apparatus Requisite for a Complete Gas Works.

Also, Gas and Water Pipe, Flanged Pipe, Sugar House Work, and Special Castings of all Descriptions.

GAS ENGINEERING COMPANY.

INCORPORATED,

Conestoga Building, PITTSBURGH, PA.



AMMONIA MACHINE.

MANUFACTURERS OF

Gas Works Machinery of all kinds,

PATENTEES AND OWNERS OF

PITTSBURGH WASHER-SCRUBBER,

SOLE AGENTS FOR

FELDMANN AMMONIA MACHINE,

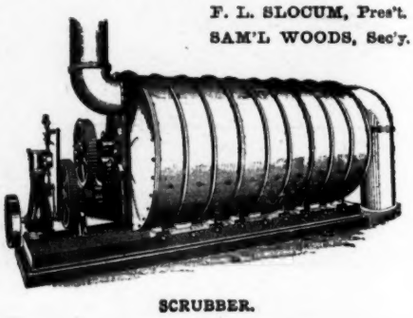
For producing Sulphate, Aqua, Chloride and Concentrated Liquors.

The Erection of Bi-Product Coke Ovens a Specialty.

Faux System of Recuperative Benches.

NEW SYSTEM HYDRAULICS.

F. L. SLOCUM, Pres't.
SAM'L WOODS, Sec'y.



SCRUBBER.

Kerr Murray Manufacturing Company,

Steel Gasholder Tanks,

SINGLE, DOUBLE AND TRIPLE-LIFT GASHOLDERS,

HORIZONTAL AND VERTICAL STORAGE OIL TANKS

Iron Work for Coal Gas Benches, Self-Sealing Mouthpieces, Exhausters, Condensers, Scrubbers, Purifiers, Wooden Trays, Floor Carriages, Center Seal and Valve System Connections. Cast and Wrought Iron Fittings, and Connections 3 to 36 Inches Diameter.

VALVES, Double Gate, Hub and Flange, Outside Screw and Quick Opening, 3 to 36 In. Diam.

COAL AND COKE WAGONS, RETORT HOUSE TOOLS, STREET MAIN SPECIALS AND DRIPS.

Address.

KERR MURRAY MANUFACTURING CO.

Fort Wayne, Indiana.

BARTLETT, HAYWARD & CO.

BALTIMORE, MD.

Triple, Double & Single-Lift

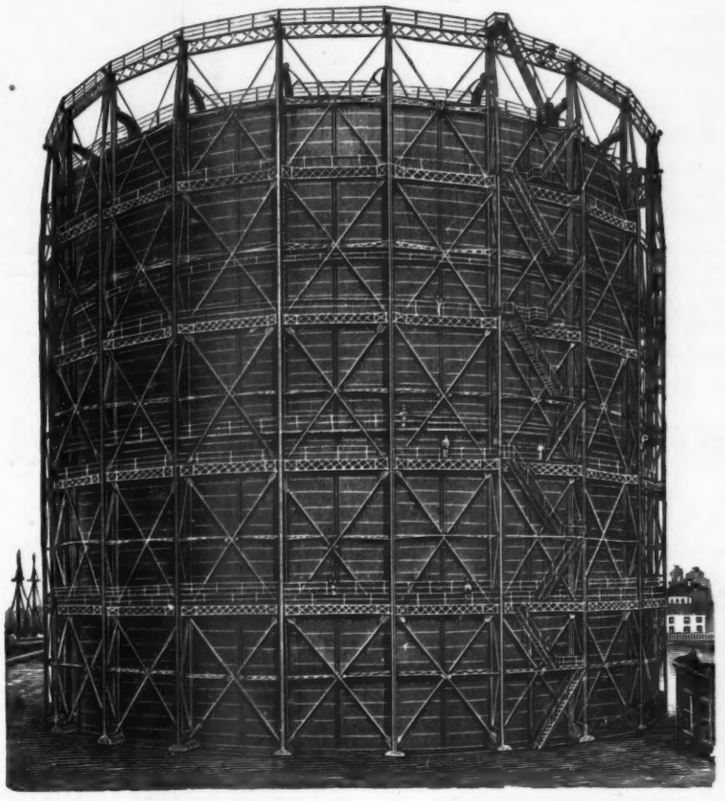
GASHOLDERS.

Iron Holder Tanks.

ROOF FRAMES.

Girders.

BEAMS



PURIFIERS.

CONDENSERS.

Scrubbers.

Bench Castings.

OIL STORAGE TANKS

Boilers.

Three Four-Lift Gasholders, each of 4,289,500 Cubic Feet Capacity, Erected in Chicago.

The Wilkinson Water Gas Process.

THIRTY-CANDLE, NON-CONDENSABLE, FIXED GAS. THE MOST SUCCESSFUL GAS PROCESS IN OPERATION.

MILL'S REVERSIBLE LIME TRAYS.

Gas Works Designed and Constructed.

PRACTICAL HANDBOOK ON

GAS ENGINES

With Instructions for Care and Working of the Same.

By G. LIECKFELD, C.E.

Translated with Permission of the author by GEO. M. RICHMOND, M.E

Price, $1.00.

A. M. CALLENDER & CO., 32 Pine Street, New York

R. D. WOOD & CO., ENGINEERS, IRON FOUNDERS, MACHINISTS.

400 Chestnut Street, Philadelphia, Pa.

MANUFACTURERS OF

CAST IRON PIPE.

BUILDERS OF

Gas Holders,

Single, Double and Triple Lifts, with or without Wrought Iron or Steel Tanks.

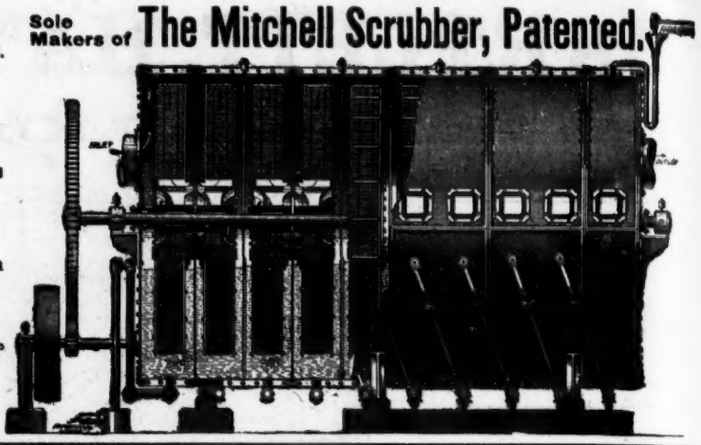
PURIFIERS, CONDENSERS, SCRUBBERS.

The Hopper Automatic Gas Governor

Send for Pamphlet.

Dunham Patent Specials.

Sole Makers of **The Mitchell Scrubber, Patented.**



ISBELL-PORTER CO.,

ENGINEERS AND CONTRACTORS FOR THE

Construction and Extension of Gas Works.

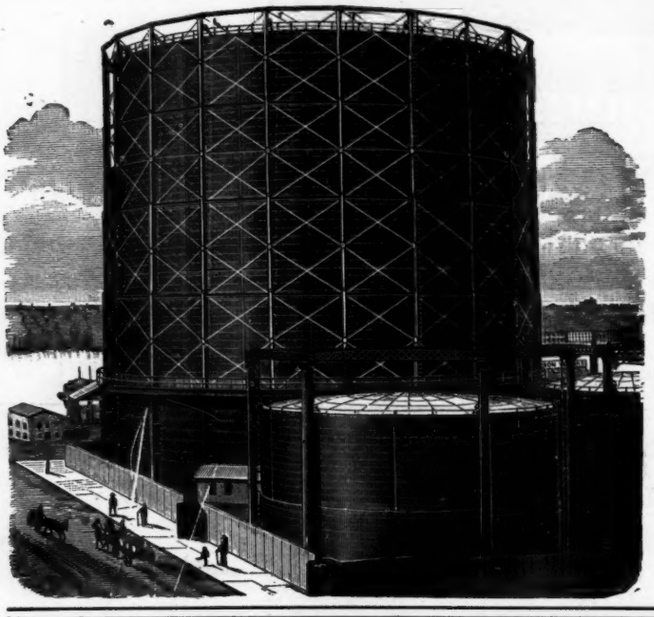
FOUNDERS AND MACHINISTS.

MANUFACTURERS OF

All Ironwork and Machinery Required in a Gas Plant.

Estimates, Drawings and Specifications furnished for the Alteration, Improvement, or Extension of Existing Works or the Construction of New Works.

245 Broadway, New York City. OFFICES **Bridge & Ogden Sts., Newark, N. J.**



The Continental Iron Works,

THOMAS F. ROWLAND, President.
WARREN E. HILL and CHAS. H. CORBETT, Vice-Presidents.
THOMAS F. ROWLAND, Jr., Secretary & Treasurer.

West and Calyer Sts. (Near 10th & 23d St. Ferries)
NEW YORK, Borough of Brooklyn.

BUILDERS OF

Gas Holders.

Single and Multiple Section Gas Holders a Specialty.

STEEL GAS HOLDER TANKS.

BENCH CASTINGS, RETORT LIDS.

Hydraulic Mains, Condensers, Scrubbers Purifiers, Valves, Etc.

Self-Sealing Retort Mouthpieces & Lids

For Round, Oval, or "D" Retorts.

ILLUMINATING GAS! FUEL GAS!

THE LOOMIS PROCESS.

Now in successful operation at Works of John Russell Cutlery Co., Turner's Falls, Mass., and Henry Disston's Son's Saw Works, Tacony, Pa.

The Cheapest Gas Generating System in the World.

Plans and Estimates Furnished.

BURDETT LOOMIS, - - Hartford, Conn.

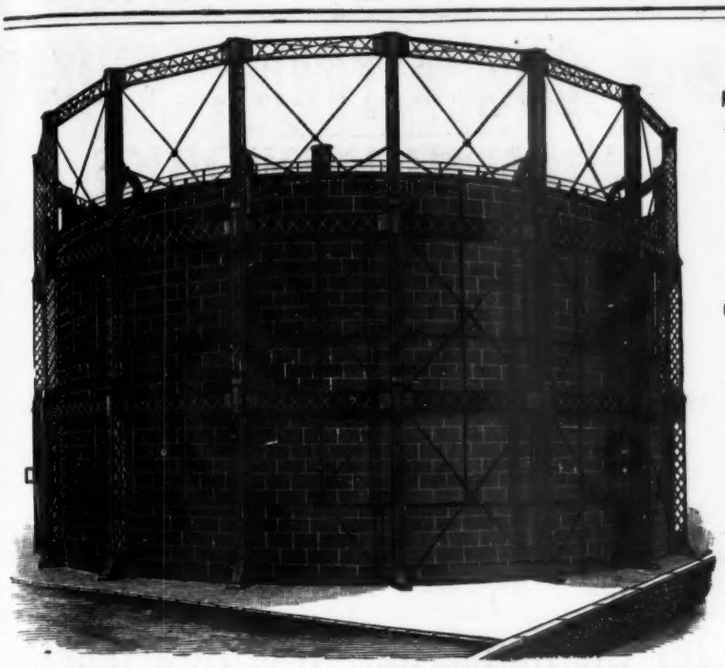
To Gas Companies.

We make to order **CAP BURNERS** to burn any amount under a stated pressure. Send for samples.

Also, SERVICE CLEANERS, DRIP PUMPS, and STREET MAIN PROVING APPARATUS,

C. A. GEHRORER,

248 N. 8th St., Phila., Pa.



H. RANSHAW, Prest. & Mangr. T. H. BIRCH, Asst. Mangr
WILLIAM STACEY, Vice-Prest. R. J. TARVIN, Sec. & Treas.

THE STACEY MANUFACTURING CO

Established 1851.

Single, Double and Triple-Lift

GASHOLDERS,

Of any Capacity, with or without Wrought Iron or Steel Tanks.

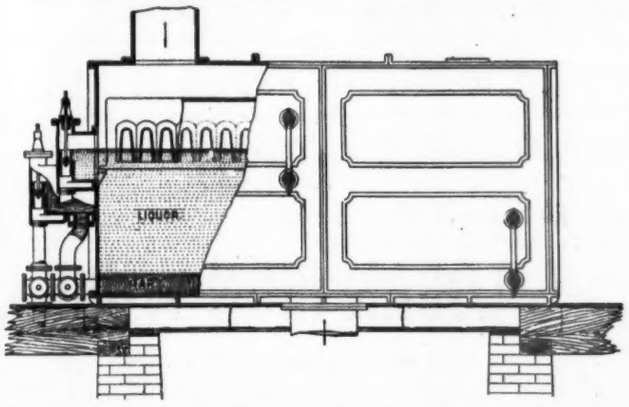
Hydraulic Mains, Condensers, Scrubbers, Purifiers, Valves, etc.

Coal Gas Benches, Roof Frames,

OIL STORAGE TANKS.

Pressed Steel Mouthpiece Lids, Self-Sealing Mouthpiece Lids.

Cincinnati, Ohio.



GEO. SHEPARD PAGE'S SONS,

SOLE AGENTS FOR THE

Walker Tar and Carbonic Acid Extractor.

During the Winter months over 12,000,000 feet of gas daily is being relieved of *all* Tar and a large percentage of Carbonic Acid by the Walker Extractor. They should be placed before all Scrubbers. The Tar and Liquor Overflow Valves work automatically. Write for Circulars.

69 Wall Street, - - New York City

GEORGE R. ROWLAND.

Formerly with the Continental Iron Works.

Draughtsman and Constructing Engineer.

Drawings, Specifications and Estimates furnished for the construction of new works or alteration of old works. Special attention given to Patent Office drawings.

Office, No. 245 Broadway, N. Y. City.

W. H. PEARSON, Prest. J. W. WESTCOTT, Gen'l Mangr. and Treas. L. L. MERRIFIELD, Chief Engr.

THE ECONOMICAL GAS APPARATUS CONSTRUCTION COMPANY, Limited

269 Front Street, East, Toronto, Canada.

ENGINEERS AND BUILDERS OF THE **IMPROVED LOWE WATER GAS APPARATUS.**

Designed to give the Greatest Efficiency when using any kind of Oil, Anthracite Coal, Gas House or Oven Coke.

New Gas Works Built, Present Gas Plants, either Coal or Water, Remodeled

Catalogues, Plans and Estimates Furnished upon Application.

WM. HENRY WHITE,

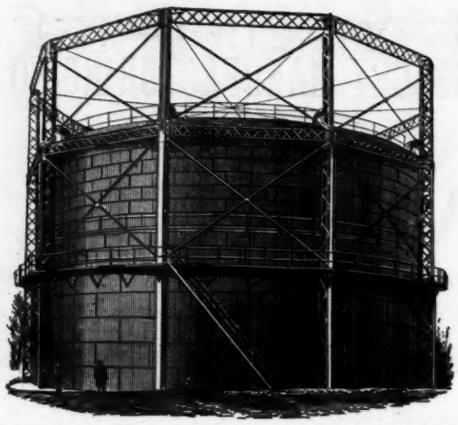
No. 32 Pine Street, - - - New York City.

ENGINEER AND CONTRACTOR FOR THE

ERECTION AND EXTENSION OF

GAS, WATER, AND ELECTRIC LIGHT WORKS.

Correspondence with Gas Companies contemplating extending or improving their Plants respectfully invited. Plans and Estimates Furnished.



1842 * Deily & Fowler, * 1898

LAUREL IRON WORKS.

Office, No. 39 Laurel Street, Philadelphia, Pa

BUILDERS OF

Gasholders

Single or Telescopic. With or Without Iron or Steel Tanks.

OIL TANKS, WATER TANKS, AND GENERAL WROUGHT IRON WORK.

JAMES R. FLOYD'S SONS,

Successors to HERRING & FLOYD,

Oregon Iron Works,

West 20th and 21st Streets, Between 10th & 11th Avenues, New York City.

Engineers and Contractors for the Construction of Gas Works.

MANUFACTURERS OF ALL KINDS OF CASTINGS AND GENERAL IRONWORK FOR GAS APPARATUS.

Bench Castings, Regenerative and Half Regenerative Furnace Castings, Condensers, Tower Scrubbers, Mechanical Scrubbers, Purifiers, Malleable Iron Retort Lids, Self-Sealing Retort Lids, Hydraulic Hoist Purifier Carriage, Crosses, Tees, Bends, Angles, Reducers, S-Bends, Sectional Sleeves, Plugs, Caps, Street Drips, etc., always on hand.

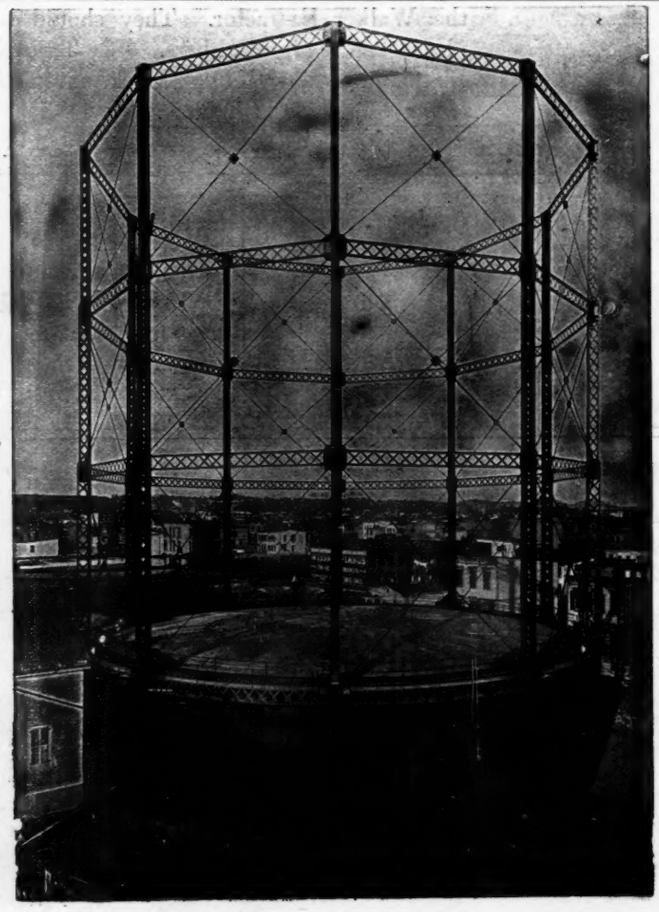
WOOD'S GAS SCRUBBING AND ENRICHING APPARATUS.

In use at Syracuse, Auburn, Watertown, Cortland and Geneva, N.Y.; Elizabeth, N. J.; Boston, Mass.; Jamaica Plain, Mass.; Providence, R. I.; Northern Liberties Gas Co., Phila.

Sole Manufacturers of the OGDEN QUICK-MOVING VALVE.

HEARNE CENTER SEAL, Operating One, Two, Three or Four Boxes.

Stroh & Osius Concentrator for Ammoniacal Liquor, used by 50 Gas Companies and Cokeries during the past 4 years.



The order for this Triple-Lift Holder and Steel Tank was received by the Logan Iron Works from the Union Gas Light Company, of East New York. The contract was completed and the Holder was in actual use in 90 days from receipt of order. Capacity of Holder, 500,000 Cu. Ft.

LOGAN IRON WORKS,

Brooklyn, N. Y.

MANUFACTURERS OF

Single or Multiple-Lift

GASHOLDERS,

Complete with Steel Tanks.

BENCHES, SCRUBBERS,

CONDENSERS,

PURIFIERS, IRON ROOFS,

Self-Sealing Retort Lids,

AND ALL PARTS OF

GAS WORKS APPARATUS

Contractors for Complete Works.

ALSO, SOLE MANUFACTURERS OF

C. W. BLODGET'S

HOT GAS SCRUBBER.

THE OHIO PIPE COMPANY,

MANUFACTURERS OF

Cast Iron Gas & Water Pipe,

BRANCH AND SPECIAL CASTINGS.

Gas-House Bench Castings, Hydraulics, Lamp Posts, Flange Pipe and Specials, Architectural Castings, Building Columns, Joists, Cellar Grates, Sash Weights, etc.

GENERAL FOUNDERS AND MACHINISTS

Columbus, Ohio.

DAVID LEAVITT HOUGH,

26 CORTLANDT ST., N.Y. CITY.

Consulting Engineer.

Investigations and Appraisals.
Designs and Estimates.

Contractor.

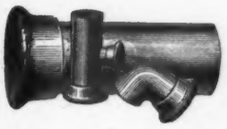
Machinery and Structures.
Gas and Water Pipe.

Special Agent for Selling & Purchasing.

WARREN FOUNDRY AND MACHINE CO.,

Established 1856. Works at Phillipsburgh, N. J.

New York Office, 160 Broadway.



CAST IRON WATER AND GAS PIPE,

FROM THREE TO FORTY-EIGHT INCHES DIAMETER. ALSO, ALL SIZES OF

Flange Pipe for Sugar House and Mine Work. Branches. Bends, Retorts, etc., etc

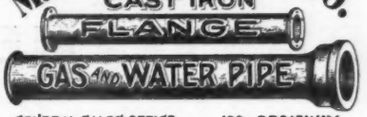
---

"GLOSE" SPECIALS, VALVES, ETC. "GLAMORGAN" FIRE HYDRANT

M. J. DRUMMOND & CO.

MANUFACTURERS OF

CAST IRON



GENERAL SALES OFFICE, 192 BROADWAY, NEW YORK.

Western Office: Monadnock Block, Chicago, Ills.

GEORGE ORMROD, Manger. & Treas., Emaus, Pa.
JOHN DONALDSON, Prest., Betz Bldg., Phila., Pa

EMAUS PIPE FOUNDRY.

DONALDSON IRON COMPANY. EMAUS, PA

MANUFACTURERS OF

CAST IRON PIPE AND SPECIAL CASTINGS

FOR WATER AND GAS.

Also, FLANGE PIPE, LAMP POSTS, Etc.

1894 DIRECTORY 1894

OF AMERICAN GAS COMPANIES

Price, - - - - - - - - - $5.00.

A. M. CALLENDER & CO., - - No. 32 Pine Street, New York.

Established 1854.

D. McDONALD & CO.,

MANUFACTURERS OF

WET AND DRY METERS, STATION METERS AND METER PROVERS.

—ALSO MAKERS OF

THE GLOVER PREPAYMENT METER.

The amount of gas delivered for the coin can be instantly and positively changed without removing the meter or replacing any parts.

The gas registered agrees absolutely with the amount purchased by the coin.

WE HAVE MADE AND SOLD IN THE UNITED STATES

OVER 20,000 OF THESE METERS,

ALL OF WHICH ARE GIVING PERFECT SATISFACTION.

Correspondence Solicited.

511 West Twenty-first Street, NEW YORK. | **51, 53 & 55 Lancaster Street, ALBANY, N. Y.** | **34 & 36 West Monroe Street, CHICAGO.**

NATHANIEL TUFTS METER CO.,

63 Beverly Street, Boston, Mass.

MANUFACTURERS OF

DRY GAS METERS.

Station Meters of any Capacity.

Test and Experimental Meters, Pressure Registers, Pressure Gauges

METER PROVERS, PHOTOMETERS, STREET LANTERNS, ETC., ETC.

Apparatus for the Chemical Testing of Gas and Gas Liquor.

Established 1849. With the best facilities for manufacturing, is enabled to furnish reliable work and answer orders promptly.

CHARLES E. DICKEY. JAMES B. SMALLWOOD. CHARLES H. DICKEY.

THE MARYLAND METER AND MANUFACTURING CO.

Established 1866.

BALTIMORE, North & Saratoga Sts. **CHICAGO, 107 West Monroe St.**
NEW YORK, 838 Broadway. **SAN FRANCISCO, 221 Front St.**
BOSTON, 92 Water Street, Rooms 21 and 22.

CONSUMERS' & STATION METERS, PRESSURE GAUGES, Etc., Etc.

"Perfect" Gas Stoves

METRIC METAL COMPANY,

MAKERS OF

GAS METERS for NATURAL and ARTIFICIAL GAS.

Special Attention given to Repairing METERS of all Makes.

FACTORY AT ERIE, PA.

Use Keystone Meters.

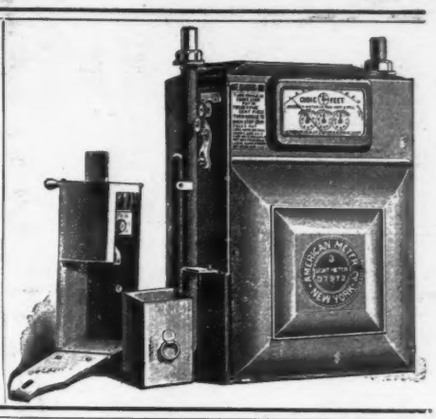
Royersford, Pa.

American Meter Co.

NEW YORK, PHILADELPHIA,
SAN FRANCISCO.

Prepayment Meters.

Their construction is such that they may be readily readjusted when the scale of gas rates is changed.



HELME & McILHENNY,

Established 1848. **1339 to 1349 Cherry Street, Philadelphia, Pa.**

MANUFACTURERS OF

Wet and Dry Gas Meters, Station Meters, Provers, Gauges, Etc.

METERS REPAIRED

PREPAYMENT GAS METERS.

Our Own Patents. Strong. Simple. PROMPT ATTENTION. CORRESPONDENCE SOLICITED.

FIELD'S ANALYSIS

For the Year 1896.

An Analysis of the Accounts of the Principal Gas Undertakings in England, Scotland, and Ireland. Being the Twenty-eighth Year of Publication. Compiled and Arranged by

JOHN W. FIELD, Sec. & Gen. Mangr. of The Gas Lt. & Coke Co., London.

Price, $5. For Sale by

A. M. CALLENDER & CO., - No. 32 Pine Street, N. Y. City.

THEODORE D. BUHL, President. CHAS. H. JACOBS, Secretary-Treasurer.

DETROIT METER COMPANY,

DETROIT, MICH.

MAKERS OF . . .

GAS METERS.

OUR equipment embraces the Latest and Most Improved Machinery. We make our own Tin Plate. We claim for **"BUHL" METERS, Increased Durability,** with probability of **Fewer and Less Expensive Repairs,** and **More Accurate Adjustment.** Comparisons invited. Meters of other Makers promptly Repaired.

MAIL ORDERS SOLICITED.

The Advertisement of the

OTTO GAS ENGINE WORKS,

33d and Walnut Streets, Philadelphia,

New York, 39 Cortlandt St., Boston, 19 Pearl St., Chicago, 245 Lake St.,

Occupies this space every alternate week.

JOHN J. GRIFFIN & CO.,

1513-1515-1517-1519-1521 Race Street, Philadelphia.

52 Dey Street, New York. WM. S. GRIBBEL, Manager.

75 N. Clinton St., Chicago. FREDERICK WAUGH, Manager.

MANUFACTURERS OF

STATION METERS, CONSUMERS' METERS,

Provers, Registers, Gauges, Experimental Apparatus, Etc.

Prompt Attention Given to All Repairing.

OUR SPECIAL NATURAL GAS METER

Is the Best ever offered.. Over 30,000 now in use.

We manufacture in the United States, under the **SAWER & PURVES PATENTS,** the

Positive Prepayment Meter.

. . SIMPLE . .

. DURABLE .

. ACCURATE .

. RELIABLE .

All Parts Interchangeable

This Meter is an unqualified success in Great Britain. Its simplicity of construction, and the positive character of the service performed by it, have given it pre-eminence.

Needs Only the Care Given an Ordinary Meter.

Saves MONEY, TIME and CONSUMERS.

Dispenses with "DEPOSITS" and Increases OUTPUT.